NCHRP
SYNTHESIS 410

NATIONAL
COOPERATIVE
HIGHWAY
RESEARCH
PROGRAM

Freight Transportation Surveys

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A Synthesis of Highway Practice

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NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM

NCHRP SYNTHESIS 410

Freight Transportation Surveys

A Synthesis of Highway Practice

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NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM

Systematic, well-designed research provides the most effective approach to the solution of many problems facing highway administrators and engineers. Often, highway problems are of local interest and can best be studied by highway departments individually or in cooperation with their state universities and others. However, the accelerating growth of highway transportation develops increasingly complex problems of wide interest to highway authorities. These problems are best studied through a coordinated program of cooperative research.

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The needs for highway research are many, and the National Cooperative Highway Research Program can make significant contributions to the solution of highway transportation problems of mutual concern to many responsible groups. The program, however, is intended to complement rather than to substitute for or duplicate other highway research programs.

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FOREWORD

Highway administrators, engineers, and researchers often face problems for which information already exists, either in documented form or as undocumented experience and practice. This information may be fragmented, scattered, and unevaluated. As a consequence, full knowledge of what has been learned about a problem may not be brought to bear on its solution. Costly research findings may go unused, valuable experience may be overlooked, and due consideration may not be given to recommended practices for solving or alleviating the problem.

There is information on nearly every subject of concern to highway administrators and engineers. Much of it derives from research or from the work of practitioners faced with problems in their day-to-day work. To provide a systematic means for assembling and evaluating such useful information and to make it available to the entire highway community, the American Association of State Highway and Transportation Officials—through the mechanism of the National Cooperative Highway Research Program—authorized the Transportation Research Board to undertake a continuing study. This study, NCHRP Project 20-5, "Synthesis of Information Related to Highway Problems," searches out and synthesizes useful knowledge from all available sources and prepares concise, documented reports on specific topics. Reports from this endeavor constitute an NCHRP report series, *Synthesis of Highway Practice.*

This synthesis series reports on current knowledge and practice, in a compact format, without the detailed directions usually found in handbooks or design manuals. Each report in the series provides a compendium of the best knowledge available on those measures found to be the most successful in resolving specific problems.

PREFACE

By Jon M. Williams
Program Director
Transportation
Research Board

Information on the movement of freight and its characteristics is essential to promoting economic efficiency and development. This information can take many forms, from classified traffic counts and travel time studies to comprehensive commodity flow and origin-destination surveys. Twelve different types of surveys are profiled in this report. Practices for each type are described and some are illustrated by case studies. Cross-cutting issues are presented—survey costs, the use of Intelligent Transportation System technologies, comparison of survey types, and the Commodity Flow Survey.

Information was gathered through literature review and a survey of state departments of transportation and selected metropolitan planning organizations, marine and airport authorities, academics, and commercial freight data purveyors.

David Kriger, Matthew McCumber, Allison Clavelle, Becky Gan, and Tavia Chow of HDR| iTRANS, Ottawa, ON, Canada, collected and synthesized the information and wrote the report. The members of the topic panel are acknowledged on the preceding page. This synthesis is an immediately useful document that records the practices that were acceptable within the limitations of the knowledge available at the time of its preparation. As progress in research and practice continues, new knowledge will be added to that now at hand.

CONTENTS

APPENDIX A OF THIS REPORT CAN BE FOUND AT
WWW.TRB.ORG, SEARCH ON "NCHRP SYNTHESIS 410."

FREIGHT TRANSPORTATION SURVEYS

SUMMARY

The efficient movement of freight is important for local, state, and even national economic viability. Understanding the movement of freight and of its characteristics is essential to promoting efficiency and economic development. A need exists to examine the different methods, techniques, and results of current efforts to survey and collect data on freight transportation. This information can take many forms, from classified traffic counts and travel time studies to comprehensive commodity flow and origin-destination surveys. However, it can be challenging to collect such information because of the complexity of the demand for freight transportation.

Several factors contribute to this complexity. For example, urban freight transportation factors include the number and varying characteristics of the decision makers, the diversity in the types of goods (i.e., commodities) carried, origin-destination and routing patterns, freight costs, units of measure, and the activities that take place in an urban area. The supply chain involves a number of decision makers in both the public and private sectors: the former as providers and owners of freight infrastructure and services and as regulators, and the latter as shippers, carriers, and distributors of goods. Finally, the movement of freight can involve several transportation modes, intermediate transfer and processing facilities, and jurisdictions.

The large range of freight survey practices reflects the complexity of freight demand and the multiplicity of influencing factors and supply chain participants. This synthesis profiles the state of the practice in methods and techniques used to survey and collect data on freight transportation. Based on the profile, the synthesis identifies important issues, identifies gaps in knowledge, and identifies areas for potential future research. Although the focus is on data that are gathered for modeling, surveys for other applications also are considered—for example, qualitative surveys on freight planning issues. The focus was on road-based freight transportation, although surveys and data on other modes also are included. Both urban and inter-urban surveys and data are considered.

The following 12 different types of surveys are profiled in the synthesis:

1. Roadside/intercept surveys
2. Combined telephone/mail-back surveys
3. Telephone interview surveys
4. Mail-out/mail-back surveys
5. Personal interview surveys
6. Internet surveys
7. Focus and stakeholder group surveys

8. Commercial vehicle trip diary surveys
9. Global Positioning System (GPS) vehicle tracking surveys [more broadly, Intelligent Transportation System (ITS) technologies]
10. License plate match surveys—manual
11. License plate match surveys—electronic
12. Administrative surveys

The synthesis describes practices in each type of survey. Several are illustrated by case studies. The description is complemented by discussions on four key topics: survey costs, the use of ITS technologies, a comparison of survey types, and the Commodity Flow Survey.

A web-based survey of practitioners was the primary source of information for the synthesis. The survey solicited information on several topics, including survey costs, practitioners' requirements for data, the data that are available to them and how these are used, and practitioners' use of ITS technologies for surveys and data collection. Practitioners also were asked to assess how well the available data met their needs. The survey was sent to all state departments of transportation (DOTs), as well as to selected metropolitan planning organizations that were known to be active in recent freight planning activities. These were the primary intended audiences. To further broaden the coverage, the survey also was sent to selected marine and airport authorities, academics, and commercial freight data purveyors. In total, 74 individual agencies were contacted.

State DOTs provided the greatest number of responses (46). This number includes three DOTs that did not participate in the web-based survey but indicated separately that they are not involved in freight surveys (i.e., the subject was "not applicable" to them). This number also includes responses from two different offices of the California DOT, which chose to respond separately: in the ensuing discussion of the results, the two responses have been combined only where appropriate. Each of the other sampled agencies responded only once. The greatest rate of return was represented by the 45 state DOT respondents, at 88% of the 51 DOTs. Overall, 55 of the solicited agencies responded, for a response rate of 74%. Table 1 presents the rates of return by agency type.

TABLE 1
RATE OF RETURN BY AGENCY

Agency	Number of Surveys Sent	Number of Surveys Returned	Number of Nonapplicable Responses	Total Number of Responses	Rate of Return
State DOTs	51	43	3	46	88%*
MPOs	15	8	0	8	53%
Marine Port/Airport Authority	2	2	0	2	100%
Federal Agency	2	0	0	0	0%
Academic	1	0	0	0	0%
Commercial Data Purveyor	2	0	0	0	0%
Other	1	0	0	0	0%
Total	74	52	4	56	74%*

*Rates reflect 45 state DOTs, as two individual offices from the California Department of Transportation responded.

The results provided a wide range of responses to virtually all the questions. However, some tendencies emerged from the state-of-the-practice:

- The range of applications was broad, with the most common applications being policy and infrastructure capacity planning. Modeling was well down on the list: although data needs for modeling and forecasting were cited as an important reason for this synthesis, the findings indicate an interest in the use of freight surveys for many applications. The large number of "other" applications also suggests that new issues and needs are emerging, and must be addressed.
- Trucks were the dominant mode of interest; however, data for other modes also were of interest. There were some common elements in the type of data required for each mode: trip origin, destination, the characteristics of the load carried, and vehicle/vessel (equipment) profiles. Additional and more specific information was required for trucks, including speed and emission data.
- Among the 12 types of surveys, roadside/intercept surveys (i.e., the most traditional form of truck survey) were cited most frequently; however, each of the other types of surveys was used as well.
- Practitioners collected both qualitative and quantitative information. To some extent this distinction also determines the type of survey that can be used (i.e., some types can be used to collect both qualitative and quantitative information, whereas others are usable for one or the other).
- Most practitioners indicated that they used external data sets (provided by others) to enhance their own databases. Among 21 public and commercial data sources presented to survey respondents, the U.S. DOT's Freight Analysis Framework, the Commodity Flow Survey, and the TRANSEARCH Insight Database were most commonly used. Most users found the external data sources to be "adequate" or "good."
- Just over one-third of the practitioners (20 of 56 respondents) used ITS technologies, with weigh-in-motion technologies and sensors being the most common applications.
- Some practitioners found shortcomings in the available freight data, whether their own data or from external sources. Specific shortcomings (in decreasing frequency of citation) included insufficient detail or inappropriate scale (most commonly cited shortcoming, and common to several data sets), as well as high cost, incomplete coverage of the freight mode, movement or commodity that is carried, datedness of the data, small sample size, incomplete geographical coverage, inadaptability of data that had been developed for another purpose, and inapplicability of the data definitions.
- Practitioners identified several needs for their freight surveys (see "Needs and Gaps Identified by Practitioners" and "Resultant Recommendations for Research" in chapter five) and also noted several factors for success in their collection of freight data:
  - Adequacy of funding (the most dominant theme)
  - Prior knowledge and experience in both the conduct of freight surveys and the analysis of the results, and among the actual surveyors
  - Appropriate survey planning aimed at addressing clearly-specified objectives
  - Effective communications with and engagement of survey participants: related to this was the willingness of respondents to provide (often confidential) information
  - Adequacy of responses, including specificity and level of detail
  - Timeliness and currency of the data (i.e., ensuring that the data are up to date and that they are processed quickly)
- Practitioners identified a range of costs for the conduct of their surveys. However, the costs lack precision, in part because of the lack of a common understanding of what components of the survey the costs comprised, and the accompanying difficulty in allocating costs among these components (and between external and internal resources).

The survey was complemented by a literature review. Case studies for five survey types were identified, mainly from the United States but also from Canada and Europe. These comprised roadside/intercept surveys, focus and stakeholder group surveys, commercial trip diary surveys, establishment surveys, and ITS technologies. The range of case studies reflects a blend of the survey types that are used most commonly in practice, but also includes several research and comparison studies that reflect emerging practice (i.e., in the use of ITS techniques). A sixth presentation describes the U.S. Commodity Flow Survey, which is different from the 12 categories of interest in this synthesis and, accordingly, was not taken into account otherwise. The presentation also includes research studies on the comparison of techniques (notably, the use of GPS), as well as summary descriptions of different survey techniques and applications.

The case studies were used to present different aspects of or variations to a specific type of survey: they describe the types of information gathered. In several cases, the descriptions are complemented by illustrations of sample survey forms; however, it is important to note that many surveys of a specific type are similar to each other and the selection of illustrations is not exhaustive.

A comprehensive survey of practitioners identified needs, current internal data collection efforts, usage of existing external public and commercial datasets, and an assessment of how well the internal and external data met users' needs. The key needs and gaps and recommended associated research needs are as follows:

1. Despite the availability of many examples of surveys and information on the techniques for conducting them, as well as several public freight data sets, respondents identified the greatest need as more information on the specifics of a vehicle trip (origin, destination, routing, shipment details, travel time, emissions, etc.). This applied to all freight modes as well as intermodal freight movement. This suggests the following research needs:
   a. The conduct of demonstration surveys to compare methods and demonstrate their practical opportunities and obstacles in actual field situations, as well as to record the operational details of the survey in progress.
   b. A detailed review of the efficacy of using existing public freight data sets as the basis for capturing vehicle trip information.

2. More research is needed into ways of further establishing the monetary benefits of new ITS technologies and of reducing the costs of new technologies.

3. Practitioners identified several ways to improve data collection deficiencies or gaps. Most frequently cited, with greatest importance, were the need to provide more detail and the need to ensure that data are collected regularly. This suggests that research should be conducted into—
   a. The practical application of survey techniques that are most effective in gathering the necessary details; for example, methods to increase sample size, exploration of new or improved existing data sources to serve as sample frames, and post-survey data treatments to address confidentiality concerns
   b. The practical application of survey technologies to gain precision and detail
   c. Survey methods (i.e., survey design, sources for sample frames, etc.) that are cost-effective and easily accessible, in order to promote increased data collection frequency and regularity
   d. Methods that could reduce the processing, validation, and expansion time and costs required before survey results can be delivered
   e. The usability and cost-effectiveness of ongoing or more frequent survey instruments, to complement or, if appropriate, replace "one-off" or infrequently conducted surveys.

4. Overall, practitioners cited the need to improve existing surveys and capabilities. This suggests the need for—
   a. A detailed guide for the conduct of freight surveys, with specific attention given to the practical considerations required for survey planning and conduct
   b. Research on the design of survey questions to improve clarity and accuracy
   c. Research on the potential impact of new technologies and techniques to address legal and confidentiality issues.

5. Research on ways to build agency staff capabilities by educating and training analysts.

Researchers also identified several gaps:

6. The need to "compare and validate" alternate techniques that could be used to gather the same type of information in order to "determine the accuracy of each, and to investigate how both can potentially be enhanced to make up for any shortcomings they have."

7. The need to better understand the global supply chain and its manifestation in the movement of freight to, from, and within the state, as well as the workings of the distribution of goods produced in the state to domestic and international markets, and of the distribution of products to the consumer.

8. The need to establish indicators; that is, to specify measures to assess the performance of goods movement. In addition, there is a need to address a lack of a "common understanding or agreement about what constitutes an urban [in this case] freight transport indicator."

Although not identified specifically by practitioners or in the literature, several other recommendations can be drawn from the findings:

9. Develop a taxonomy of freight survey types, common definitions, and a common set of indicators of performance.

10. Develop methods to improve the precision and level of detail of existing surveys, notably through the integration of ITS technologies into the surveys.

11. Compare and assess all aspects of surveys, from sample definition and selection to survey techniques and post-survey analysis. This comparison could be done through a series of pilot or site-specific tests.

CHAPTER ONE

INTRODUCTION

CONTEXT

The efficient movement of freight is important for local, state, and national economic viability. Understanding the movement of freight and its characteristics is essential to promoting efficiency and economic development. There is a need to examine the different methods, techniques, and results of current efforts to survey and collect data on freight transportation, data that can take many forms, from classified traffic counts and travel time studies to comprehensive commodity flow and origin-destination surveys. Because of the complexity of the demand for freight transportation, however, it can be challenging to collect.

Several factors contribute to this complexity. For example, urban freight transportation factors include the number and varying characteristics of the decision makers, the diversity in the types of goods (i.e., commodities) carried, origin-destination and routing patterns, freight costs, units of measure, and the activities that take place in an urban area. The supply chain involves a number of decision makers in both the public and private sectors: the former as providers and owners of freight infrastructure and services and as regulators, and the latter as shippers, carriers, and distributors of goods. Finally, the movement of freight can involve several transportation modes, intermediate transfer and processing facilities, and jurisdictions.

OVERVIEW

Purpose

The large range of freight survey practices reflects the complexity of freight demand and the multiplicity of influencing factors and supply chain participants. The purpose of this synthesis is to improve the state of the practice in freight transportation survey methods. The synthesis has four specific goals:

- Develop a profile of the current state of the practice in methods and techniques used to survey and collect data on freight transportation, through a community survey and literature review.
- Based on this profile, identify the important issues concerning survey types, purpose, sample size, geographic scope, data integration, proprietary and restricted-use information, cost, and existing agency guidelines.
- Make recommendations regarding ways to improve the state of the practice.
- Identify gaps in knowledge and areas for potential future research.

Given this scope, it is important to note that although the applications of freight surveys are broad, the Project Panel cited the role of surveys in modeling as being particularly important.

Subject

This synthesis focuses on existing methods used to collect data on freight transportation and agency guidelines. Several different aspects of freight transportation surveys are considered:

- Purposes for which data are collected and the survey methods appropriate for each purpose
- Survey types, including the following:
  - Roadside interviews
  - Web-based surveys
  - Mail-in [i.e., mail-out]/mail-back surveys
  - Vehicle intercept
  - Telephone call-in [i.e., call-out]/call-back
  - Personal interviews
  - Vehicle tracking
  - License plate match
  - Administrative data
  - Focus and stakeholder groups/Delphi techniques
- Survey sampling issues
- Regional and corridor versus statewide survey issues
- Design of surveys at different levels to enable data integration
- Cost of surveys and data collection
- Proprietary and restricted-use information issues
- Guidelines used by agencies in formulating freight transportation surveys to meet specific data needs
- Gaps in knowledge and research needs, including for guidelines.

Consideration also is given to the feasibility of linking survey data with data from informatics such as roadway, on-board vehicle, and wide area sensors.

Scope

The Project Panel has defined the scope of this synthesis by the following points:

- The emphasis is on the road-based movement of freight; that is, surveys of truck freight. However, it is important to note that data for other freight modes (rail, air, water, intermodal, and pipeline) also are taken into account in the survey of practitioners (see the next section, Study Process) for purposes of completeness of coverage.
- The synthesis examines both urban and inter-urban surveys.
- The focus is on U.S. state and regional agencies, but the synthesis also includes select national agencies, port authorities, and purveyors of commercial freight data.
- The synthesis focuses on U.S. practices, but also considers practices in other jurisdictions.
- The scope of freight survey techniques considered does not include traffic counts.
- The synthesis focuses on the most recent survey experience, in order to appropriately represent the prime objective of the state of the practice. However, where appropriate, reference also is made to older surveys.

Study Process

The synthesis focuses on the *practice* as opposed to academic or theoretical considerations; although the latter are noted if they were relevant. The basis of the synthesis is information that was gathered in two ways: a review of the literature and a web-based survey of state departments of transportation (DOTs), selected metropolitan planning organizations (MPOs), and selected national agencies, port and airport authorities, and commercial purveyors of freight data. Thus the synthesis primarily considered the practices of state and regional planning agencies, but also considered other significant participants in U.S. freight data collection activities. It also assembles opinions and interpretations as well as factual information. Case study examples are used to illustrate the different approaches and best practices: these are drawn from the survey and from the literature.

Finally, it is important to note that this synthesis focuses on the technical aspects of the state of the practice in freight transportation surveys. It is not intended to be judgmental with respect to the policies of individual organizations or how these organizations have used the resultant freight transportation data. Nor is the synthesis intended to advocate particular policies or practices; rather, it attempts to present an unbiased and accurate summary of the state of the practice.

ORGANIZATION

This synthesis is organized into four chapters. The remainder of chapter one identifies the intended audiences for the synthesis, and presents various definitions for terms that are used in the text.

Chapter two discusses the method for the literature review and for the surveys, as well as the assumptions for conducting the literature review, the survey, and the interviews. This chapter is not intended to be a detailed discussion, but rather to ensure that the reader understands how the information was gathered and any caveats or comments that may be associated with the information.

Chapter three summarizes the state of the practice in transportation survey methods, as derived from a survey of practitioners that was conducted for this work. This chapter documents and synthesizes current practices used to collect freight transportation data, characteristics, and important issues of each survey type.

Chapter four complements the practitioners' survey results with case studies from the literature. The chapter also includes a comparison of survey techniques.

Chapter five concludes the work with a series of recommendations for future research in the area of freight transportation surveys, based on the practitioners' survey and the case studies.

There are three supporting sections to the text: a list of references, a bibliography of sources and a glossary of selected terms. Finally, two appendixes complement the synthesis. Appendix A (a web-only section of this report) contains a copy of the web-based survey questionnaire with a complete tabulation of the survey results. Appendix B lists the organizations that responded to the survey.

AUDIENCES

This synthesis is intended to serve as a resource primarily to state DOTs and MPOs that have some or all of the following freight data collection activities:

- Freight transportation data are required to provide input for transportation operations and transportation planning and investment decisions.
- Freight transportation data collection initiatives are administered, either internally or externally by a consultant.
- Freight data are purchased from commercial sources.

Many national government agencies are involved with conducting various freight data surveys, such as the country-wide Commodity Flow Survey. These sources of data and their uses also are considered.

CHAPTER TWO

METHOD FOR SURVEY AND LITERATURE REVIEW

This chapter documents the methods and assumptions for conducting the literature review and the survey. It discusses the research method, sources of literature, a practical review of the literature, and the purpose of and approach to the survey in order to give a greater understanding of the process and of the subsequent findings.

OVERVIEW OF METHOD

The information upon which this synthesis is based was gathered in two separate tasks. The primary task was a survey of practitioners, which was complemented by a literature review.

The survey was sent primarily to all state DOTs, as well as to selected MPOs that were known to be active in freight transportation. The survey also was sent to select national agencies, port authorities, and commercial purveyors of freight data. This diversity in the survey group was intended to capture the viewpoints and experience on freight data collection activities from as many participants involved in the process as possible. Participants completed the survey online through a web-based survey program.

The literature review began with a search for any resources that had the potential for further review. An online search was conducted using transportation resource websites and search engines to gather further resources. From this search, available electronic resources were gathered. This was complemented by contacts with Panel members, members of selected TRB freight committees, and selected academics to request resources that they believed might be relevant. The agency representatives were also asked if they would be able to provide any other sources of information (e.g., published reports, journals, articles, etc.) as well as any other individuals or organizations that might provide further assistance. Any leads that were obtained from discussions with other professionals were pursued to their end. The consultant's internal library also provided valuable publications and reports.

SURVEY OF PRACTICE

Survey Development

The survey "Freight Transportation Surveys—Existing Methods and Guidelines" was conducted primarily between May and October 2009. Before the survey was distributed, it was necessary to establish a comprehensive outline and test the survey to ensure that it was as accurate and target-specific as possible.

During the initial stages of constructing the outline of the survey, it was decided that it would also be beneficial if the survey could be answered by several different types of agencies that are involved in the freight transportation data collection process. A logical way to construct the survey was to structure the questions as close-ended as possible, in order to provide a clear indication of what was being asked and to help in the summary process. Most of the questions were asked with a selection, or list, of answers, and the respondent was instructed to select a single answer or as many answers as applied, depending on the question. However, because of the nature of the subject, a standard set of answers may not always have covered all the options. Accordingly, for most questions there was also the option to select "other," with space provided to expand on the answer.

The survey targeted the following key information:

- Who was the survey respondent?
- What is the purpose or application for the freight transportation survey(s) and/or data collection?
- What methods are used to collect the data?
- What are the characteristics of the data being collected?
- What public and/or commercial data sources are used?
- What data are needed or unavailable?
- What were respondents' experience with their survey practices and any other available data?

The survey was divided into six self-contained sections. This made the survey more "respondent friendly," in order to specifically target areas of interest in the process. Also, the survey was divided into sections because the online survey answers are only received after each section is completed; if the survey was only one section and the respondent "abandoned" the survey partway through, no answers would be received.

The first section determined the type of agency that was responding to the survey and who from that agency was responding. It also asked respondents what purpose and what transportation modes are considered in their freight transportation surveys and/or other data collection activities.

Section 2 asked if the respondent's organization administers or funds surveys or data collection initiatives to obtain freight data, and if yes, what techniques were used. For each technique used, the respondent was asked to describe the data collected.

Section 3 asked respondents what are their freight data requirements by listing general and mode-specific freight data and by asking if they currently use the data, need data that are are not available, or have data that are not applicable.

Section 4 determined which public and commercial data sources the respondent used, and to comment on their quality and shortcomings.

Section 5 asked what ITS technologies were used and what their potential is for integration with other data collection initiatives. The respondent also was asked to comment on the benefits and barriers of linking freight survey and informatics data.

The final section, Section 6, asked respondents to comment on their existing freight transportation data needs, what improvements need to be made to existing data sources, future intentions concerning expansion of their data collection activities, and for any "lessons learned" from their surveying and other data collection experiences.

Taking all these pieces together, Section 1 identifies the needs for freight data, and sections 2–5 depict the state of the practice (methods and sources). Gaps and needs are identified throughout: comments on quality and shortcomings, barriers, availability of data and detailed assessments in section 6.

Although the survey may have required a relatively long time for some respondents to complete (of the order of 40 to 60 minutes), most respondents could complete the survey in a reasonable amount of time. This was possible because an option was provided at the beginning of each new topic for respondents to skip nonapplicable questions using inherent conditional branching.

Following approval of the draft survey by the TRB Project Officer, the consultant conducted a pilot survey session internally to assess the usability and readability of the survey before sending it to all participants. Minor modifications were made to the survey following the pilot survey session. Subsequently, the survey was sent to all state DOTs, MPOs with potential freight data survey experience (as identified through the literature or by the Project Panel), and select national agencies, port authorities, and commercial purveyors of freight data throughout the United States.

The survey was sent to each group by e-mail under the name of the TRB Project Officer. TRB and the Project Panel provided contact names and e-mail addresses of the respective representatives from state DOTs, MPOs, port authorities, and national agencies, and the consultant provided contact names and e-mail addresses for the commercial purveyors. Follow-up e-mail reminders were sent to those who had not yet responded (which could be determined because each respondent could be tracked, confidentially) and follow-up telephone calls were made to state DOTs that had not completed the survey within approximately 2 months of the initial survey invitation. The follow-ups also ensured that the appropriate person(s) within each state DOT received the questionnaire. However, for reasons of confidentiality, these individuals cannot be identified.

To expedite the entire process of distributing the survey and to facilitate respondents' ability to read, respond to, and return it, it was decided that it should be distributed via e-mail. The practitioner was asked to complete the survey online through an online survey hosting company. A PDF version of the survey was included in the initial e-mail to enable the respondent to print the survey and review the questions before completing it online. Printing also assisted some respondents in gathering the information needed to complete the survey. To return the online survey, the participant simply had to submit the responses by clicking a button at the end of each section of the survey. The consultant provided support throughout the process by means of e-mail correspondence, as well as a toll-free telephone number that was provided with the survey.

Upon review of the survey responses, telephone interviews were initiated with selected respondents to follow up where additional information was required or to seek more information if an exceptional practice was identified.

Appendix A presents the survey questions and a complete tabulation of responses to each question. (This questionnaire, a web-only document, appears longer than the actual online survey, because the software structure incorporates branching and formatting that cannot be shown here.)

Sample and Responses

The survey was distributed to all state DOTs, as well as to selected MPOs that were known to be active in recent freight planning activities. These were the primary intended audience. To further broaden the coverage, the survey also was sent to selected marine and airport authorities, academics, and commercial freight data purveyors. In total, 74 individual agencies were contacted.

The greatest number of responses (46) was received from state DOTs. This number includes three DOTs that did not participate in the survey but that indicated separately that they are not involved in freight surveys (i.e., the subject was "not applicable" to them). This number also includes responses from two different offices of the California DOT, which chose to respond separately: in the ensuing discussion of the results, the two responses have been combined only where appropriate. Each of the other sampled agencies responded only once. The greatest rate of return was represented by the 45 state DOT respondents, at 88%. Overall, 55 of the solicited agencies responded, for a response rate of 74%. Table 1 in the previous chapter presents the rates of return by agency type.

SOURCES FOR LITERATURE REVIEW AND DATA

The literature review and sources of data mainly focused on U.S. practice and experience. However, the freight transportation surveys and data collection practices in several other regions such as Canada, the European Union, and Australia provided helpful insight on the state of the practice. In such cases, resources were also compiled based on international experience.

Relevant publications and reports were located by various search methods, including the following five sources of information:

- Online Transportation Research Information Service (TRIS);
- DOT and MPO websites;
- Documents provided by DOTs, MPOs, academic institutions, and the Project Panel;
- Academic and practitioner contacts identified by the consultant and the Project Panel; and
- The consultant's internal library.

CHAPTER THREE

FREIGHT TRANSPORTATION SURVEYS: STATE OF THE PRACTICE

INTRODUCTION

This chapter describes the state of the practice as determined from the practitioner surveys. Following this introduction, the discussion is organized according to the six survey sections:

1. Applications of existing data collection are described in Applications.
2. Survey methods and data characteristics are described in State of the Practice for each of the different types of surveys that are included in the study scope. The Survey Costs section discusses survey costs for each of the survey types. The Data Availability and Dissemination section reviews data availability and dissemination.
3. Practitioners' freight data requirements are discussed in Freight Data Requirements.
4. Practitioners' use of public and commercial data sources is presented in Use of Existing Data Sets.
5. Practitioners' use of ITS technologies for surveys and data collection is described in Use of Intelligent Transportation System Technologies.
6. Finally, User Assessment of Data presents practitioners' assessment of how well current surveys and data meet their needs. The section also provides a discussion of lessons learned.

It is important to note that the information was provided in confidence. Accordingly, individual respondents or facilities are identified only generally (e.g., "state DOT"). Appendix A provides a complete summary of the survey results and is a web-only document.

APPLICATIONS

Table 2 tabulates the purposes and transportation modes that respondents consider in their freight transportation surveys and/or data assembly. Note that respondents were asked to identify all relevant applications and modes.

TABLE 2
APPLICATIONS AND MODES CONSIDERED IN FREIGHT TRANSPORTATION SURVEYS/DATA

Application/ Mode	Truck/ Highway	Rail	Air	Marine	Intermodal/ Cross-modal/ Multimodal	Total
Infrastructure Capacity Planning	43	26	19	19	27	134
Modeling	39	11	7	6	9	72
Cost-benefit Analysis	24	17	7	10	12	70
Land Use Planning	20	6	8	8	9	51
Operations and/or Safety Analysis	32	17	14	10	15	88
Environmental Impacts	25	16	14	12	16	83
Policy	38	28	24	25	29	144
Total	221	121	93	90	117	642

Several observations may be made regarding this table:

- The range of applications was broad, with 642 applications cited. The dominant applications were policy (144 citations) and infrastructure capacity planning (134). Modeling was well down on the list, at 72 citations; operations/safety analysis (88) and environmental impacts (83) each garnered a greater number of citations. All types of applications were cited, with cost-benefit analysis cited almost as frequently as modeling (70 times) and land use planning cited the fewest (51) times. This broader range is consistent with the findings of a 2004 study of urban freight data needs, which pointed out that the data are needed for infrastructure planning, operations, safety, and environmental issues, in addition to the more traditional applications in planning and modeling. That study also grouped data needs into five categories: cargo; road transportation; major freight generators and corridors; non-road transportation modes; and economic, land use, and socioeconomic data (1).
- Trucks/highways were the dominant mode, at 221 citations. However, each of the other modes also was important. Rail was next, at 121 citations. Intermodal, cross-modal, and multi-modal had 117 citations. Next

was air (93), and finally marine (90). Again, the dominance of trucking and the range of modes are consistent with the breadth of interest cited in the 2004 study (*1*).

- Table 2 does not include the following "other" applications:
  - Understanding the economic importance of transportation facilities and needs
  - Supporting the activities of a freight study or of a freight task force (i.e., a freight council)
  - Performance measures and management (from both user and owner perspectives)
  - Customer satisfaction and marketing among users
  - Provide "voice" to shippers
  - Informing plans and policies, including routing, service coverage areas, bottlenecks, corridor studies, master plans, systems plans, and goods movement action plans
  - Assisting in data fusion and trend analysis (also a function of the need to collect all types of data)
  - Identifying gaps and priorities
  - Toll feasibility analysis
  - Reporting for the calculation of fees, including statewide rail safety fee
  - Analysis of the movement of hazardous materials
  - Administration of grants and loans
  - Calibration of a combined land use, economic and transportation model
  - Refinement of a strategic investment system plan.
- The importance and broad application of data are encapsulated in one respondent's comment that "the ways in which decision makers seek freight data and ask question is limitless. There are no areas of freight data that do not apply. The proprietary nature of freight data and the myriad of freight transportation projects [dictate] that freight data of all types [must] be captured."

Table 2 describes both data that were collected by the respondent and data that were assembled from other sources. In comparison, only 37 of the 56 respondents (66%) indicated that they actually administer or fund the data collection: in other words, a significant number of respondents use data from other sources, and agencies may both collect and assemble data.

There was a range of activities among the respondents who administered or funded surveys and data collection. The practitioners' survey indicates that at least some agencies supported more than one type of survey and data activity. As Figure 1 indicates, roadside/intercept surveys were most frequent (25 citations), followed by focus and stakeholder groups and personal interviews (18 citations each) and almost half conducted personal interviews (17 respondents). Next were mail-out/mail-back surveys (14), telephone surveys (12), and combined telephone and mail-out/mail-back surveys (7). Among newer electronic technologies, Internet (web) surveys were cited by 12 respondents, electronic license plate matching by seven respondents (the same number that cited manual license plate matching), and Global Positioning System (GPS) vehicle tracking by five respondents. Commercial vehicle trip diaries were cited only by four respondents. Other survey types comprised [truck] toll revenues, motor carrier identification surveys, and multimodal freight studies.

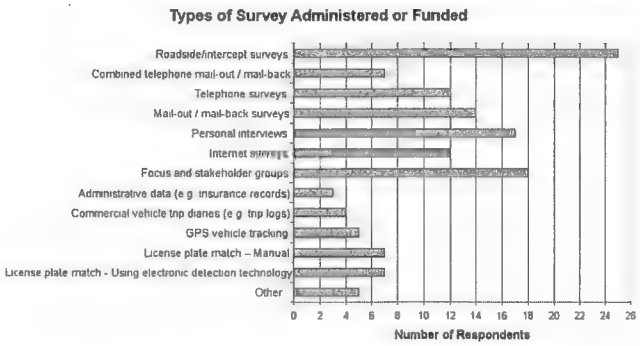


FIGURE 1 Types of surveys conducted by respondents.

Table 3 compares the applications for which the surveys were (or were to be) used. Respondents were asked to indicate all applications, and the number of citations—306—indicated that the surveys commonly were used for many applications. By far the most common application was infrastructure or facility planning, with 88 of 296 citations (30%). Demand management and traffic safety applications were next, at 52 and 49 citations respectively. Logistics planning, land use planning, and air quality management followed, at 34, 26, and 24 citations respectively. These applications generally were well distributed across all survey types. Several other purposes also were cited, although never exceeding five citations: notably, modeling was cited by only five respondents.

Table 4 indicates that many respondents conducted several types of surveys and data activities jointly. Roadside/intercept surveys (40 citations), telephone surveys (20), mail-back surveys (18), personal interviews (26), and focus group/stakeholder surveys (18) most commonly were conducted with other survey types, notably personal interviews (31), telephone surveys (26), and focus group/stakeholder surveys (25).

Table 5 describes the geographic coverage of the surveys. The coverage ranged from facility- and corridor-specific to urban, state, national, and international in scale. Statewide coverage was cited most commonly (43 occurrences), followed by corridor-specific and regional (26 and 25 citations respectively). One additional respondent specified corridor-specific across this respondent's state. These tendencies generally were prevalent across all survey types.

Table 6 describes the modes that were covered in the surveys. Trucks dominated, at 105 responses, followed by rail (34), marine (28), intermodal (27), and air (24). Three respondents covered all modes. Again, these tendencies generally were prevalent across all survey types.

TABLE 3
SURVEY APPLICATIONS

	Roadside/ intercept surveys	Telephone	Mail-out/ mail-back	Combined telephone/ mail-back	Commercial vehicle trip diary surveys	Internet surveys	Personal interviews	Focus/ Stakeholder groups	GPS vehicle tracking surveys	License plate match – manual	License plate match – electronic	Administrative	Other	Total
Land Use Planning	3	4	1	1	0	1	7	6	1	0	2	0	0	26
Infrastructure/Facility Planning	24	9	10	6	0	3	11	12	2	2	3	1	5	88
Traffic Safety Operations	13	5	4	3	0	3	5	7	2	2	2	1	2	49
Demand Management	17	5	5	2	2	1	7	7	2	0	2	1	1	52
Air Quality Management	6	3	2	1	1	0	3	4	1	0	0	1	2	24
Logistics Planning	8	3	4	3	0	1	6	6	0	0	1	1	1	34
Modeling									1				1	2
Validation of Other Data	3	1			1									5
Routing Analysis	2													2
Economic Impact/Performance/ Activity	2													2
Facility Management		1		1			1							3
Communications	1			1										2
Policy/Planning/ Programming				1		1								2
Customer Satisfaction/ Business Development/ Market Research		1	1			1	1	1						5
Outreach/Potential Projects/Perceptions		1					1						2	4
Origin-Destination Data for Freight		1	1				1							3
Variety			1										1	2
Other, Not Specified				1										1
Total	79	34	29	20	4	11	43	43	9	4	10	5	15	306

TABLE 4
INCIDENCE OF JOINT SURVEYS

	Roadside/ intercept surveys	Tele-phone	Mail-out/ mail-back	Com-bined telephone/ mail-back	Com-mercial vehicle trip diary surveys	Internet surveys	Personal inter-views	Focus/ Stakeholder groups	GPS vehicle tracking surveys	License plate match – manual	License plate match – electronic	Admini-strative	Other	Total
Roadside/Intercept Surveys	7	0	1	0	0	0	3	3	1	3	1	1	0	20
Telephone Surveys	3	5	3	2	1	0	6	2	1	1	0	0	2	26
Mail-out/Mail-back Surveys	3	2	2	1	0	1	4	3	0	1	0	0	0	17
Combined Telephone Mail-out/Mail-back	2	1	2	1	0	0	1	1	0	0	1	0	0	9
Commercial Vehicle Trip Diaries (e.g., trip logs)	1	1	0	0	1	0	0	0	0	0	0	0	0	3
Internet Surveys	0	1	0	1	0	0	1	1	1	0	0	0	0	5
Personal Interviews	9	4	4	1	0	2	5	3	1	1	0	0	1	31
Focus and Stakeholder Groups	3	3	4	0	0	2	4	3	1	1	2	0	2	25
GPS Vehicle Tracking	0	0	0	0	0	0	0	0	0	0	0	0	0	0
License Plate Match—Manual	1	1	0	0	0	0	0	0	0	0	0	0	0	2
License Plate Match—Electronic	8	0	0	0	0	0	0	0	0	0	0	0	0	8
Traffic Counts	0	2	2	1	0	1	1	2	1	0	1	0	0	11
Administrative Data	3	0	0	0	0	0	1	0	0	0	0	0	0	4
Other (PIERS data)	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Total	40	20	18	7	2	6	26	18	6	7	5	1	6	162

TABLE 5
GEOGRAPHIC SCOPE OF SURVEYS

	Roadside/ intercept surveys	Telephone	Mail-out/ mail-back	Combined telephone/ mail-back	Commercial vehicle trip diary surveys	Internet surveys	Personal interviews	Focus/ stakeholder groups	GPS vehicle tracking surveys	License plate match – manual	License plate match – electronic	Admini-strative	Other	Total
Facility-specific (bridges and tunnels)	1	0	0	0	0	0	0	0	0	0	0	0	1	2
Facility-specific (marine ports)	0	0	0	1	0	0	0	0	0	0	0	0	0	1
Corridor-specific	7	1	3	1	0	1	4	4	1	2	1	0	1	26
Urban Area	2	0	1	1	0	0	0	0	1	0	1	0	0	6
Regional	5	5	4	0	2	0	2	3	0	1	1	0	2	25
Statewide	10	5	4	4	0	3	6	8	0	0	0	2	1	43
Statewide and Corridor-specific	1	0	0	0	0	0	0	0	0	0	0	0	0	1
National	0	1	0	0	0	0	1	0	0	0	0	0	0	2
International	1	0	0	0	0	0	1	0	1	0	0	0	0	3
Total	27	12	12	7	2	4	14	15	3	3	3	2	5	109

TABLE 6
MODES SURVEYED

	Roadside/ intercept surveys	Tele-phone	Mail-out/ mail-back	Combined telephone/ mail-back	Commercial vehicle trip diary surveys	Internet surveys	Personal interviews	Focus/stake-holder groups	GPS vehicle tracking surveys	License plate match – manual	License plate match – electronic	Admini-strative	Other	Total
Truck	25	10	10	4	4	2	12	14	3	7	7	2	5	105
Rail		4	5	1		2	7	11	0			1	3	34
Air		4	4	0		2	7	6	0			1	0	24
Marine		5	5	1		2	8	5	0			1	1	28
Intermodal		2	4	2		3	4	9	0			1	2	27
All Modes			1						0			0	2	3
Shippers/Market (all modes)		1		1										2
Autos and Buses							1							1
Other (not specified)													1	1
Total	25	26	29	9	4	11	39	45	3	7	7	6	14	225

TABLE 7
ORGANIZATIONS SURVEYED

	Roadside/ intercept surveys	Telephone	Mail-out/ Mail-back	Combined telephone/ mail-back	Commercial vehicle trip diary surveys	Internet surveys	Personal interviews	Focus/ Stakeholder groups	GPS vehicle tracking surveys	License plate match – manual	License plate match – electronic	Administrative	Other	Total
Vehicle Operators		5	6	4	0	1	9	9	2	2	2	2	3	45
Shippers/ Receivers		8	7	3	1	2	11	11	0	1	1	1	3	49
3PLs		5	3	1	0	1	3	8	0	0	0	1	3	25
Service Vehicles		1	0	0	1	0	1	1	0	0	0	1	1	6
Terminals/Ports		6	5	1	0	2	7	10	1	1	0	1	3	37
Distribution Centers		4	3	1	1	1	5	9	0	0	0	1	3	28
Other									0			0		0
Ocean Carriers				1										1
Public		1		1										2
Manufacturing, Warehouse, Retail, Transportation		2	1		1									4
Communit Economic Development		1	1											2
Planning Agency						2								2
Passenger Vehicles			1											1
Railroads, Motor-Carriers, Trailer							1	1			1		1	4
Freight Forwarders, 4PLs													1	1
Facility Owners													1	1
Drayage Operators							1							1
Border Managers								1						1
Transportation-Managers								1						1
Military								1						1
Corridor Advocacy Group								1						1
Users								1						1
Total	0	33	27	12	4	9	38	54	3	4	4	7	19	214

Table 7 describes the types of individuals or organizations that were surveyed. A broad range of interests is apparent. Among the 214 citations, shippers/receivers and vehicle operators dominated (49 and 45 citations respectively), followed by terminals/ports (37), distribution centers (28), and third- and fourth-party logistics providers (26). Six service operators were cited, as were four public planning and economic development agencies.

STATE OF THE PRACTICE

The literature identifies several different types of surveys and, as discussed here, there are many ways to categorize and define these surveys. However, the project scope identified 10 specific survey types to be used for this Synthesis (see also chapter one, Subject).

Each is described in the following subsections. However, to better reflect the actual practice (i.e., as manifested by the 12 types described in the practitioners' survey) several modifications were made to the aforementioned list:

- Two sets of survey types were combined (roadside interview and vehicle intercept, and personal interview and focus and stakeholder groups).
- The discussion of license plate matches was subdivided into manual and electronic techniques.
- The discussion of mail-back and telephone surveys was brought together but also expanded to allow for telephone/mail-back combinations.
- Commercial vehicle trip diary surveys (i.e., driver surveys) were added as a new category.

The Panel's original categories have been reordered to link the discussion of similar types together and generally to provide a logical flow from most common to least common, traditional to new technologies, quantitative to qualitative, and technical to administrative.

All told, this analysis resulted in 12 separate survey types. Each type is discussed in turn here. Drawing from the practitioners' survey, each discussion includes a definition and a discussion of the key attributes (including "lessons learned," frequency, and sample) with selected categories augmented by case studies where appropriate. A 13th category is provided for "other" survey types that were not otherwise included.

Roadside/Intercept Surveys

Survey Description

Roadside/intercept surveys involve face-to-face interview surveys of vehicle drivers along a road or highway. These are typically used to capture data about the characteristics of the current trip: specifically, the trip origin and destination, goods carried (and their characteristics), and vehicle type (*2*). Some surveys also ask about the vehicle's route.

These surveys normally involve working with police or appropriate law enforcement agency to pull over moving vehicles/drivers and interview them at the roadside about their current trip. They also can be conducted at off-road locations such as weigh stations. The surveys usually are relatively brief, so as not to disrupt drivers and to avoid causing unnecessary traffic congestion. Roadside surveys, although most commonly cited by practitioners, are not used as often as in the past because of cost and the need for other agency involvement (e.g., law enforcement) (*2*).

Attributes

Twenty-three respondents provided details regarding their roadside/intercept surveys. Appendix A, a web-only document, contains the complete responses. Key points to note are as follows:

- Roadside/intercept surveys were used most commonly for inter-urban goods movement [20 citations; 35 citations if cross-border (9), international (6), and rural (2) were included]. Thirteen respondents indicated that these surveys were used for urban goods movement.
- A mix of information was collected, with some respondents indicating that only origin-destination data were collected. Others also collected data on the goods and cargo, although to different extents. The data were used to corroborate truck counts: however, one respondent noted that they were "basically doing counts" and needed assistance from the state DOT to collect more data.
- Surveys were conducted at different locations, including toll plazas, weigh stations, and at the entrance to a marine port (which served ocean-going vessels).
- One respondent noted that the roadside survey was "difficult and cumbersome, [but] very valuable." Another respondent noted strong cooperation from drivers.
- The sample size varied, with the largest numbers of respondents indicating samples of between 1,000 and 9,999 vehicles (eight responses), and between 100 and 999 (nine responses). (The question was posed to respondents in terms of categories of ranges.) One respondent in this group noted that this represented a 10% sample (part of a statewide study). One respondent indicated a sample size of between 10,000 and 49,000 vehicles, with the surveys conducted at toll plazas (i.e., when the vehicle was stopped); and this respondent indicated that a change to electronic toll collection technology would require a new method, including the use of mail-back surveys in addition to roadside interviews. No larger or smaller sample sizes

were identified. Five respondents indicated they were unsure or did not respond.

- Each respondent had conducted roadside survey within the past 9 years, including three conducted in the year of this study. The respondent with the oldest survey (2000) planned to conduct another one in 2009.
- However, most (10) surveys were conducted infrequently, on a one-time basis or only as needed. Seven respondents conducted roadside surveys every 5 years, and one conducted surveys every 10 years. Three respondents conducted roadside surveys annually. Five respondents indicated this was the first time the survey had been conducted.
- Respondents reported several successes with the surveys:
  - Some respondents indicated that they had collected significant amounts of data.
  - The surveys produced unanticipated findings. One respondent gathered "new viewpoints on intermodal facilities from shippers as well as [on] rail programs." Another respondent "discovered truck route information from drivers that differed from planning assumptions."
  - Another respondent reported "average successes" with the survey; however, "limited funding" restricted the range of studies to which the data could be applied.
  - One respondent "successfully sampled approximately 10% of the daily traffic at all locations." Another cited the importance of incentives in achieving a 15% to 20% response rate.
  - Another success reported was using privately operated truck stops as data collection points (i.e., as opposed to public facilities such as weigh stations or by the side of the road).
- Respondents also reported some problems and challenges:
  - One respondent, although satisfied with the response rate, noted that 10% of the data were "lost," and that "interviewers' knowledge of the system and the [trucking] industry, along with critical thinking [and] reflective listening, [are] critical for valid data." Another respondent noted the need to appropriate personnel to conduct personal surveys.
  - Another respondent noted the "huge" challenge in obtaining vehicle registration data for use in determining origin-destination patterns.
  - Two respondents noted that the collected data were limited to inter-urban flows (although these data were "rich"). Accordingly, intraregional and urban goods data were not captured, and corridor coverage was "incomplete."
  - One respondent noted that the location of the surveys also was important.
  - One respondent noted that, although a "tremendous amount of data" was gathered, there was a need to keep the surveys "as organized as possible when it comes to data entry and coding [as there is a] high potential for mistakes/human error."
  - Another respondent noted that "so much more" needed to be done in terms of surveys, given that "basically" the only data collected were counts.
  - Finally, one respondent acknowledged the complexity of freight surveys, by noting that "the devil is in the details."
- Respondents also noted several "critical" types of data that were missing from the collected survey data:
  - Off-hour/night-time trips—that is, the full 24-hour data. In one case, "limited resources" were cited as the reason these data were not collected.
  - Additional days [beyond the day(s) surveyed]
  - Small sample size (i.e., much activity is not captured)
  - Information on final destination, in cross-border surveys
  - Loaded versus empty movements
  - Detailed addresses for origin and destination information. These were not collected because of "legal" considerations.
  - Small trucks and intraregional trips, which were not captured because the roadside surveys were conducted at weigh stations.
  - Characteristics of the goods being transported
  - Movements at more "ideal" (i.e., representative) times of year
  - Rest area activity over a full 24-hour period
  - Logistics details.
- Respondents expressed a wide range of comments on the quality of the collected data. Some expressed satisfaction with that data: "we got what we were looking for;" "very useful and representative," "statistically significant based on 8–9 daytime hours," "helped to focus on specific areas of need." Others were less satisfied with the "usefulness, completeness [or] representativeness" of the data:
  - One respondent noted that the data represented only a single day. Another commented that the data were incomplete, but these were "the best available." A third noted that the quality was adequate but the sample size was too small "to do appropriate statistical analysis."
  - "Better survey mechanism[s]" was needed to improve quality.
  - One respondent expressed quality in varying degrees: "about 90% [satisfaction] on origin and destinations; about 80–90% on routing; less than 60% on commodities."
  - One respondent noted that the "quality of the data was useful and [thorough]." The data were captured using personal digital assistants (PDAs), and that each new set of data was downloaded regularly into a database and then reviewed for "potential errors."

- Finally, one respondent noted the value of combining survey results into a regional/national truck [origin-destination] database. However, "this would require shared standards on [method] and definitions."

Combined Telephone/Mail-Back Surveys

Survey Description

This method combines the use of telephone and mail-back surveys. Generally, selected respondents are called by telephone to screen their eligibility for the survey (for example, by ascertaining that they generate freight activity), verify the appropriate contact person to whom the survey should be directed, and solicit their participation. Qualified and participating respondents are then sent a paper survey form (or the form is delivered to them) to be returned by mail (or picked up). In some surveys, respondents have provided their information to the surveyor by telephone in lieu of the paper survey form.

Attributes

The practitioners' survey yielded seven responses to this category. There was considerable variation in the attributes of the seven surveys. Key points to note are the following:

- Five of the respondents had conducted combined telephone/mail-back surveys, most recently in 2009 (two respondents) and as far back as 2003. The seventh survey had not yet been implemented.
- The survey frequency also varied, from annually or biannually for the customer satisfaction surveys and up to every 5 years. Two respondents indicated they were unsure or that there was no established frequency.
- The survey purposes varied. Some surveys had more than purpose and application. These included customer satisfaction surveys (two respondents), a statewide long range plan, a statewide transportation demand management plan, facility management, economic impact assessment of road closures, and communications.
- The greatest number of these surveys (four) had statewide coverage. Corridor-specific, port-specific and urban each was cited once.
- The sample size and sampling frame also varied, according to the purpose of the survey. One customer satisfaction survey sampled 100 to 999 firms; the other sampled 1,000 to 9,999 people. The statewide transportation plan sampled 1,000 to 9,999 people. An ad hoc survey sampled one to 99 vehicles.
- Three respondents identified specific successes and lessons learned for combined telephone/mail-back surveys. One respondent's survey provided an "effective benchmark and tracking of customer service needs and delivery." Another respondent commented that the survey yielded "good information"; however, the results reflected a "local context" that must be translated into a "statewide view." The third respondent noted the challenge of developing a survey "that is short enough to get [the] desired information without being too long to decrease participation."
- Finally, respondents generally expressed satisfaction with their surveys: "includes relevant issues" (i.e., no "critical" data were missing), "useful," "[had] a good representative sample." One respondent cited the merits of "effective tracking [methods]" to verify survey responses as an important factor.

Telephone Interview Surveys

Survey Description

Telephone surveys gather information from a selected respondent through a telephone call in which the interviewer poses a series of pre-set questions and records the respondents' answers. The respondent may or may not be notified in advance (e.g., by mail) and may or may not be pre-screened to ensure eligibility or to set up an appointment for the telephone call in order to allow the respondent time to prepare. The interviewer may record responses on paper for subsequent coding or directly into a computer, which in turn can validate responses in real time or prompt the interviewer to solicit corrections or probe further. Questions can be quantitative and/or qualitative.

Attributes

The practitioners' survey yielded 12 responses to this question. Key points were as follows:

- The telephone surveys were conducted for a variety of purposes, ranging from freight stakeholder outreach surveys that solicited input regarding potential projects and motor carrier satisfaction surveys (i.e., with services provided by a government agency) to surveys conducted as part of MPO and statewide freight plans. One respondent noted that the survey had two main purposes: to gather "qualitative and quantitative information from stakeholders" and "to provide state and local transportation officials an opportunity to interact with freight stakeholders to learn more about freight considerations."
- Although some surveys focused on the identification of issues, others gathered quantitative and fact-based information about the respondent, such as (in this case, from a survey of firms' business operations): location, industry type, facility type, number of trucks by size, truck type and ownership, and number of employees; the respondent's trip-making characteristics also were solicited.
- Most surveys had been conducted within the past 3 years, although two were conducted as early as 2003.

- The frequency ranged between once or twice yearly to every 5 years. However, most respondents indicated that these surveys were conducted as needed, randomly or once only.
- The surveys were mainly regional or statewide in geographic scope, with five respondents each. One survey was focused on a specific corridor, and another was national in coverage.
- Most of the telephone surveys targeted business establishments (8). Five surveys had sample sizes of 100 to 999 firms and three had sample sizes of one to 99 firms.
- Several lessons were learned, notably:
  - One respondent noted that the telephone surveys were time consuming, with some responses incomplete. There also was difficulty in getting the appropriate person to answer the questions. A second respondent attributed a relatively low response rate to respondents' inability to answer key questions. A third respondent noted that response rates could be improved with a shorter survey, with interviews no more than 10 minutes long.
  - Another respondent noted that stakeholders' time constraints often dictated their method of response. "The surveys were intended to be in person, but the stakeholders preferred conducting the interview over the phone. In some cases, the survey questions were answered via email interaction due to stakeholders' time constraints."
  - A fifth respondent noted variation in the responses to a statewide freight outreach survey owing to "public/political differences" across the state.
- Critical missing data including routing information and "more survey respondents."
- Respondents generally were satisfied with the quality of their data, although with qualifications:
  - Respondents' willingness to divulge information about themselves varied (i.e., business operations).
  - Respondents' ability to provide specific information also varied.
  - In one survey, whose sample was designed to ensure that a wide range of shipper (industry) types was covered, a good "cross sample of data was obtained." However, several major goods generators did not respond.

Mail-out/Mail-back Surveys

Survey Description

Mail-out/mail-back surveys gather information by mailing a form for the respondent to complete and mail back. Often, a cover letter explaining the purpose of the survey and a postage-paid return envelope are included with the form. These surveys are passive (i.e., self-administered), although assistance may be available by telephone or Internet and typically a set of instructions is included with the form. The advantage of this method to the survey sponsor is its relatively low unit cost compared with some methods (e.g., in-person or telephone calls); however, there is little ability to screen eligibility among respondents. This survey type also has been used in lieu of roadside surveys in locations where it would be unsafe to divert drivers (e.g., high-volume expressways) or where confidentiality concerns prohibited direct interviews: this requires the recording of a license plate number, the registered owner of which is then mailed a survey form. From the respondents' perspective, this survey method offers some flexibility and ease in that it does not require an Internet connection and can easily be passed among different respondents within the same organization. On the other hand, erroneous responses can only be cleaned and corrected once the completed survey has been returned, and data must be coded manually or scanned into a computer. Questions can be quantitative and/or qualitative.

Attributes

The practitioners' survey yielded 12 responses to this question. Key points were as follows:

- The mail-out/mail-back surveys were conducted for a variety of purposes. These included freight stakeholder outreach surveys, consultation for statewide freight plans, roadside surveys (as described earlier), and in combination with telephone surveys "to increase response."
- Surveys captured both quantitative data (freight origin-destinations), whereas others gathered qualitative information: "qualitative system evaluation," input on "potential projects," and "perceptions of transportation."
- Most surveys had been conducted within the past 3 years, although one was conducted as early as 2003.
- Almost all the mail-out/mail-back surveys were conducted infrequently, as needed or once only. One respondent indicated that the survey was conducted every 5 years "at most."
- The surveys were mainly regional or statewide in geographic scope, with four respondents each. Three focused on specific corridors and one covered an urban area.
- The mail-out/mail-back surveys targeted firms and vehicles equally (four citations each), although freight stakeholders ("people") also were sampled. Five surveys had sample sizes of 100 to 999 firms or vehicles, and four had sample sizes of one to 99 firms, vehicles, or people. A roadside mail-out/mail-back survey had a sample of 10,000 to 49,000 vehicles.
- One respondent noted that the surveys were successful in gaining insight into what the "major shipper[s were] thinking." However, others cited a mixed experience:
  - One respondent cited a 10% return rate but noted that some of the responses indicated that the

intended respondents were not made clear, either in the cover letter or because of stakeholders' misunderstanding.
  - Another respondent noted the need to follow up with respondents in order to achieve a good rate of return.
- Critical missing data comprised responses from "some of the larger freight generators in the state."
- Respondents generally had mixed reactions regarding the quality of their data:
  - One respondent indicated satisfaction with the survey, which was intended to gather "qualitative feedback on [the adequacy of and issues with] system operations [and on] business needs and issues that the [state] DOT should be aware of."
  - Another respondent indicated that the data were good "but not complete or thorough."
  - Finally, a third respondent indicated that the data were of "poor quality" and the surveys must be "redone."

Personal Interview Surveys

Survey Description

Personal interview surveys gather information from a selected respondent through a telephone call or face-to-face interview in which the interviewer poses a series of pre-set questions and records the respondents' answers. The respondent may or may not be notified in advance (e.g., by mail, telephone, or by being intercepted), and may or may not be pre-screened to ensure eligibility or to set up an appointment for the interview in order to allow the respondent time to prepare. The interviewer may record responses on paper for subsequent coding or directly into a computer, which in turn can validate responses in real time or prompt the interviewer to solicit corrections or probe further. Questions can be quantitative and/or qualitative.

Attributes

The practitioners' survey yielded 13 responses to this question. Key points were as follows:

- Personal interview surveys were conducted for a variety of purposes, ranging from continuous surveys and the gathering of information for specific initiatives or for updates of existing information (e.g., port and airport volumes), to the development of a business plan for the distribution industry and a statewide freight plan.
- The surveys gathered qualitative input, which was used for long-range planning and policies, assess customer satisfaction, promote business development, profile areas of economic activity, get a "pulse" of the system, and estimate future needs.
- Almost all the personal interview surveys had been conducted within the past 3 years, with the oldest survey conducted in 2005.
- Survey frequency varied from continuous and "quarterly," to an as-needed basis, and approximately every 5 years.
- The surveys were mainly statewide in geographic scope (six citations) or corridor-specific (four citations). There were two regional personal interview surveys and one occurrence each of national and international personal interview surveys.
- Seven surveys had sample sizes of one to 99 individuals, and three each had sample sizes 100 to 999 and 1,000 to 9,999 (the latter comprising one continuous survey and one internal "as-needed" survey).
- Respondents noted several successes with the surveys. One respondent noted that personal interviews were the "most important activity to determine priorities for policy and investment improvements." Another respondent noted that, although the personal interview surveys were limited, "some information is better than none." Lessons learned included the following:
  - One respondent noted that the personal interviews were "expensive and time consuming." A second respondent noted the need for a "better mechanism" to gather this type of information.
  - Another noted the difficulty of obtaining "in-depth information from shippers, e.g., competitive issues."
  - A third respondent noted that its internal survey provided "good background information and insight into complex issues," although the respondent acknowledged that these [internal] surveys provided only "limited perspective of the situation."
- Critical missing data comprised information that was missing "due to proprietary data problems," as well as a lack of specificity.
- Respondents generally were satisfied with the quality of their data. One respondent noted that the information was used to support quantitative data. Another respondent noted that the survey "was useful in identifying relevant issues" but recognized that its small sample size was not representative. A third noted that assurances of confidentiality precluded any follow-up with respondents regarding the issues they raised. A fourth respondent noted that interviews with facility managers proved very effective. Finally, a fifth respondent noted that personal interviews were "good," provided the appropriate people were available to respond.

Internet Surveys

Survey Description

Internet surveys are conducted via the World Wide Web. Sampled respondents can be recruited via telephone, mail,

or e-mail, then—if they meet eligibility criteria—they are directed to an Internet link to complete the survey. Participants also can be invited to participate directly, such as through a targeted e-mail list that points to a link (as in the case of the practitioners' survey that was developed for this Synthesis). Finally, participation can be opened (uncontrolled) with access provided to any respondent who wishes to participate, for example through an advertisement in user group publications. As with mail-out/mail-back surveys, this method also is passive, although its ability to reach a very large number of users can make its unit costs quite low. Internet surveys have been used to solicit qualitative input, and more recently have been used for quantitative surveys.

Attributes

Four respondents indicated they had conducted Internet surveys. Key points were as follows:

- Internet surveys were used mainly for freight/intermodal planning studies.
- One respondent noted that the survey was used to a planning education and information dissemination program. Another respondent indicated that the survey was not used to gather freight data; the focus was on qualitative information. A third respondent noted that its Internet survey was used to gather quarterly data, yielding "valuable local and regional trends."
- Three of the Internet surveys had been conducted within the past 2 years, with the fourth conducted in 2005.
- Two of the surveys were conducted on an as-needed basis, a third was conducted every 1 to 2 years, and the fourth survey was continuous.
- The surveys were mainly statewide in geographic scope (three citations), with one corridor-specific survey.
- Each of the surveys had samples of different size, ranging from one to 99 firms to 100,000 or more individuals (this last for the continuous survey).
- Respondents noted several successes with the surveys. Respondents use terms such as "valid" and "valuable" to describe the input. One respondent noted that "people prefer to take surveys via Internet" and that it was "easy to tabulate the results."
- One lesson learned was that "some of the recipients do not have access to a computer."
- Critical missing data comprised the "volume of commodities shipped in pounds."
- Respondents generally were satisfied with the quality of their data ("excellent," "gives a more accurate picture of each corridor individually"). However, one respondent noted that although the data were useful, they were "not always complete."

Focus and Stakeholder Group Surveys

Survey Description

Focus and stakeholder group surveys are used to solicit qualitative comments and perceptions regarding issues, new programs and similar. Focus group surveys often are conducted face-to-face among small groups. Stakeholder surveys can be conducted face-to-face or by telephone, mail, or Internet.

Attributes

Fifteen respondents indicated they had conducted focus and stakeholder group surveys. Key points were as follows:

- Focus and stakeholder group surveys were used for a variety of purposes: input to freight plans (including study technical advisory committees), freight advisory committees or councils, issue-specific stakeholder consultation (e.g., for emissions and for a statewide truck-only lane initiative), outreach and communications, and highway corridor studies.
- Twelve of the surveys had been conducted within the past 3 years, with others conducted as early as 2002.
- The frequency of the surveys ranged from bimonthly to 5 years, with a large number conducted as needed.
- The surveys were mainly statewide in geographic scope (eight citations), with four corridor-specific surveys and three regional surveys.
- Most surveys were conducted among groups of one to 50 participants (10 citations). Three were conducted with groups between 50 and 99 individuals, and two more were conducted with groups up to 499 participants. Among all the surveys described in this Synthesis, these had the most varied audiences: shippers/receivers (11 citations), terminals/ports (10), vehicle operators (9), distribution centers (9), third-party logistics providers (8), border managers, transportation managers, service vehicles, rail and motor carriers, facility users, the military, and a corridor advocacy group.
- Respondents reported both successes and lessons learned. Successes included:
  - Ability to interface with stakeholders, both in groups and via one-on-one interviews.
  - Ability to bring together "business representatives in the state" for a statewide freight planning study, from whom the respondent "learned quite a bit about planning issues that [the agency was] not considering, particularly to plan beyond state borders."
  - One state DOT had "an active and ongoing participation in the planning processes of all federally-mandated Metropolitan Planning Organizations in [the state], which function as the coordinating committee for transportation and freight issues that bring together city and county governments, State DOTs

and representatives of U.S.DOT (Federal Highway and Transit Administrations). It is worth specifically noting that [the State DOT] has full and active participation in [its] Freight Mobility Plan Technical Advisory Committee for the [state's largest MPO] and the Metropolitan Planning Organizations for [some marine port cities]. The [State DOT] also [has a] close working relationship with the [state ports authority, which manages the aforementioned ports], which functions as the liaison with shippers, terminal operators, etc."
  - One respondent reported that the results of the stakeholder "forum" became the starting point for a statewide freight advisory committee, which in turn supported the statewide freight plan.
- Several lessons also were reported:
  - There was a need to better manage stakeholders' expectations.
  - Some respondents noted that the focus and stakeholder group surveys had limited success, for several reasons: difficulty in getting representatives of the invited stakeholders to attend the meetings, lack of follow-through, politically charged meetings; "modest penetration" of the stakeholder group, and meetings that were dominated by "major players." One respondent noted that one of the stakeholders (the state motor transport association) was a "voting member" of the initiative's steering committee.
  - Critical missing data were identified as more information regarding the supply chain (final destination of the goods being transported), the logistical needs of the private sector, and other nontrucking modes (i.e., rail). One respondent commented that its focus and stakeholder group surveys should have been supported by other efforts to get more participation.
  - Respondents expressed mixed satisfaction with the quality of their surveys. One respondent found the results "modestly useful," and another noted that the low turnout and lack of input from the attendees limited the usability of the results. A third noted the need for the survey to be part of a larger effort. However, one respondent noted that the information was "specifically" useful in working with the private sector and in reconciling the varied planning horizons of interest among the different participants. Another noted that the concerns of stakeholders were helpful to the planning process. A third respondent noted the "excellent quality [of the surveys, which yielded] great first-hand accounts and a good network to follow the logistics paths in the state."

Commercial Vehicle Trip Diary Surveys

Survey Description

Commercial vehicle trip diary surveys are used to collect detailed information about the activities of a single vehicle, usually over a single day or a few days. They can provide data about exact locations served, route, arrival and departure times, time taken for delivery/collection/servicing, type of goods/services, and the like. They typically are self-completed by the driver or by another suitably informed employee of the freight operator. These surveys gather information the characteristics of the trip (e.g., location of stops, activity at stops, arrival/departure times, itinerary, parking, goods transported). The driver or another vehicle occupant must record the activity at each stop (*2*).

Attributes

Two respondents indicated they had conducted commercial vehicle trip diary surveys. Key points were as follows:

- One trip diary survey was conducted for an MPO's truck travel and congestion study, and the other was conducted as part of another MPO's urban goods movement data collection study as input to a truck trip model update.
- Both surveys were conducted in the past 2 years.
- The truck travel and congestion study was conducted once only; the trip diary survey was conducted every 4 years.
- Both surveys were regional in geographic scope.
- The truck travel and congestion survey sampled 100 to 999 vehicles; the trip diary survey sampled 1,000 to 9,999 vehicles.
- The truck travel and congestion survey was successful: "The survey was designed to gather information [such as] location of facility; type of facility; industry type; number of trucks by size; type of trucks; truck ownership; number of employees at facility; percent of trips delivering to multiple locations; percent of trips delivering to single location; [and] nature/land use of destinations. The survey duration was not more than 15 minutes, with a reasonably good response rate. These types of surveys have [proven] to be very effective for sectors like manufacturing, wholesale, and warehousing, where trip making characteristics seem to involve a finite set [and number] of destinations or land use types, and also where the starting and ending point of trips seem to be at these facilities."
- The other respondent noted, as a lesson learned, that the "useful" number of responses was "very low," with "81 of the 392 selected companies [returning] 362 diaries."
- However, the collected data were "completely relevant to [the] truck trip model update."

- One respondent commented that response rates could be improved by having a shorter survey, with less than 10 minutes per interview.

Global Positioning System Vehicle Tracking Surveys

Survey Description

GPS refers to "a federal system of satellites which allow the user to pinpoint any location using triangulation" (3). The latitude and longitude of a GPS receiver (which may be located, for example, onboard a vehicle or in a cell phone) can be determined through satellite transmissions.

Attributes

Five respondents indicated they had conducted GPS surveys. Key points were as follows:

- One survey measured truck performance. Two other GPS surveys were conducted to track truck border crossing times, with one of these surveys also recording routes.
- The border crossing time/routing survey is ongoing and continuous. The other border crossing study was conducted in 2009. The truck performance study was underway at the time of the response.
- The truck performance study covered an urban area; the two border crossing studies were described as covering a specific corridor and an international area.
- The other border crossing study and the truck performance study each recorded samples of 100 to 999 vehicles. No sample size was given for the third survey.
- The border crossing time/routing survey was "very effective." However, the other border crossing study of wait times only provided "adequate to good" data.
- For the truck performance measurement study—which was a pilot effort—the respondent noted that it was "challenging and time consuming to secure access to the [GPS providers'] data and [to get the appropriate] contracts in place." However, the respondent also noted that "companies have been very willing to share data and participate" in the study.
- Respondents found the quality of the collected data to be "reasonable" and "very good," although one respondent noted that information differentiating travel times by time of day was missing.

License Plate Match Surveys—Manual

Survey Description

License plate match surveys involve the recording of all or part of a vehicle's license plate as it passes through two or more points along one or many facilities or corridors. In this way, the vehicle's movement through the facility or corridor is traced—for example, along a section of an expressway, whereby the entrance and exit interchanges can be identified along with through traffic. Through expansion of the surveys with traffic counts, an origin-destination matrix for the facility or corridor can be identified. Manual license plate matches involve the recording of the license plate data and, as appropriate, the vehicle type, by the human eye. The data can be recorded on paper or electronically (e.g., into a spreadsheet), or through audio recordings. License plate surveys have the advantage of being unobtrusive to the traveling public.

Attributes

Three respondents reported their manual license plate match surveys. Key points were as follows:

- Surveys were both old (2003) and recent (2009).
- The surveys were conducted on an as-needed basis.
- Two surveys were corridor-specific, and a third covered a region.
- One survey recorded a sample size of one to 99 vehicles, a second survey had a sample size of 100 to 999 vehicles, and a third survey recorded a sample size of 1,000 to 9,999 vehicles.

License Plate Match Surveys—Electronic

Survey Description

These surveys are similar to manual license plate match surveys, except that the data are recorded electronically using video recorders. The recorded data subsequently are transcribed manually into spreadsheets for processing. The use of recording devices can allow for greater accuracy in the records, reduced labor costs, and larger sample sizes. It also provides a permanent record of the observations. Newer technologies digitize and translate the data directly, thereby eliminating the manual transcribing step.

Attributes

Three respondents reported their electronic license plate match surveys. Key points were as follows:

- Surveys were conducted at different times, including as far back as 2003.
- Most surveys were conducted as needed, although one was conducted every 5 years.
- One survey was corridor-specific, a second covered an urban area, and a third covered a region.
- Two surveys recorded sample sizes of 1,000 to 9,999 vehicles. A third survey had a sample size of between 50,000 and 99,999 vehicles.
- One respondent noted the benefits as providing "an excellent source for identifying a corridor traffic pro-

file." A second respondent noted that these surveys "[do] not interrupt the traveling public."

- Respondents also noted some limitations to the data: Two respondents noted that the data were samples only, with one respondent observing that "plate surveys are taken only 2–3 times in a week [so] data [are] often not [a] representative sample of the traveling public." Another respondent further noted that the data were "good for a marketing survey, but due to time constraints and budget considerations, [the survey] does not provide ... a good representative sample." Finally, one respondent noted that these surveys "cannot completely verify the actual origin and destination of the trip from which [the data were] captured [and] in terms of determining the % of through traffic [the survey data were] not very accurate."

Administrative Surveys

Survey Description

Administrative surveys refer to information-gathering exercises that capture data that are not related specifically to transportation planning—for example, vehicle ownership and registration, insurance, shipment value, and the like. These data may be collected for financial record-keeping, legal, security, insurance or other administrative purposes.

Attributes

Two respondents indicated they had conducted administrative surveys. Key points were as follows:

- The administrative surveys were conducted for a study of drayage activity at a large port and for a freight mobility study.
- Both surveys were conducted in the past 2 years.
- The port drayage survey was conducted once only; the freight mobility survey was conducted every few years.
- Both surveys were statewide in geographic scope.
- One survey sampled one to 99 individuals (who were asked to report on tons and value of the goods being shipped); the other sampled 1,000 to 9,999 vehicles.
- No successes were reported. However, one respondent noted that the completeness, representation, and usefulness of the data were all satisfactory.
- One lesson learned was that "[the contracting procedure with an external] administrative department is very complicated and time consuming" (i.e., these arrangements were required in order to gather the requisite information).
- Critical missing data were commodity flows and data detailed at the county level.

Other Surveys

Five respondents indicated that they conducted "other" types of surveys. These included:

- A truck toll revenue data survey, which recorded "basic information" about the types of vehicles (i.e., number of axles) that used the respondent's bridges and tunnels by time of day and by method of payment. The survey is conducted continuously, and sampled more than 100,000 firms.
- A trucking company marketing survey, which accounted for 10,000 to 49,999 vehicles. This survey is conducted as needed, and was last conducted in 2002.
- A product survey (in this case, a "virtual container yard"), which sampled one to 99 firms in 2009 and is ongoing. The survey comprised "personal meetings and phone interviews with key stakeholders on product need, design, use and pricing is an iterative survey process as product is developed and tested."

SURVEY COSTS

Respondents to the practitioners' survey were asked to indicate the approximate cost range of their "last" survey. Table 8 summarizes the results. By far the most common cost range was less than $0.5 million (76 of 103 responses, or 74%). This was followed by $0.5 to $1.0 million (15 responses), and the remaining three indicated survey costs were for the $1.0 to $5.0 million range.

Table 9 summarizes the allocation of the costs between internal resources and external resources (e.g., consultants or equipment). The allocations ranged between 0% (i.e., all costs were external) and 100% (there were no external costs), with a 20% internal split being the most common category (39 of 99 responses, or 39%). The responses suggest that most of the costs of data collection are external to the agency, although the 100% internal category represented almost one-quarter (23%) of the respondents.

These findings should be considered with caution for several reasons:

- The responses to both questions were approximations only.
- The responses represent categories, within which there can be considerable variation.
- There can be variation in costs within a survey category according to the exact nature of the activity.
- Finally, as one respondent commented, the data and survey activities were conducted as part of a comprehensive planning study, and it was difficult to separate the proportion of costs attributable to surveys and data collection from the overall study costs.

TABLE 8
APPROXIMATE COST OF LAST SURVEY

	Roadside/ intercept surveys	Telephone	Mail-out/ mail-back	Combined telephone/ mail-back	Commercial vehicle trip diary surveys	Internet surveys	Personal interviews	Focus/ stakeholder groups	GPS vehicle tracking surveys	License plate match – manual	License plate match – electronic	Administrative	Other	Total
<$0.5 m	16	9	8	5	1	4	11	11	1	3	2	2	3	76
$0.5–$1.0 m	5	0	0	1	1	0	1	3	2	0	1	0	1	15
$1.0–$5.0 m	1	1	1	0	0	0	0	0	0	0	0	0	0	3
$5.0–$10.0 m	0	0	0	0	0	0	0	0	0	0	0	0	0	0
>$10.0 m	0	0	0	0	0	0	0	0	0	0	0	0	0	0
N/A	1	1	4	0	0	0	1	0	0	0	0	0	2	9
Total	23	11	13	6	2	4	13	14	3	3	3	2	6	103

N/A = not available.

TABLE 9
PERCENTAGE OF SURVEY COSTS THAT ARE INTERNAL

	Roadside/ intercept surveys	Telephone	Mail-out/ mail-back	Combined telephone/ mail-back	Commercial vehicle trip diary surveys	Internet surveys	Personal interviews	Focus/ stakeholders groups	GPS vehicle tracking surveys	License plate match – manual	License plate match – electronic	Admini-strative	Other	Total
0% internal	2	0	1	0	0	0	2	2	1	0	0	0	1	9
20% internal	9	4	3	5	1	2	3	7	0	0	1	1	3	39
40% internal	3	0	0	0	0	0	1	0	0	0	0	0	0	4
60% internal	3	2	1	0	0	0	1	1	0	0	0	0	0	8
80% internal	0	0	0	0	0	0	1	1	1	0	1	0	0	4
100% internal	3	3	4	1	0	2	3	3	0	1	1	1	1	23
N/A	4	2	1	0	1	0	2	1	0	1	0	0	0	12
Total	24	11	10	6	2	4	13	15	2	2	3	2	5	99

DATA AVAILABILITY AND DISSEMINATION

Respondents to the practitioners' survey were asked to describe the availability and dissemination of their survey results to the public and to other external agencies. These questions provide some indication of the ability of data 'owners' to share data and results.

Table 10 indicates that the large majority of respondents (78 of 98 respondents, or 80%) made their data available to the public or to other external agencies. All but one of these respondents provided the data free of charge.

Table 11 summarizes how the data were disseminated. Hardcopy reports and electronic data dissemination were both widely used, with the latter cited slightly more frequently (73 versus 69 citations respectively). (Note that respondents could respond to all applicable methods, meaning that many respondents made both hardcopy and electronic reports available.) One respondent indicated that its data were available online.

FREIGHT DATA REQUIREMENTS

Section 3 of the survey asked respondents to describe the type of data they use or need. Table 12 lists seven different types of data, and distinguishes them according to whether or not respondents currently use the data, they need the data but the data are not available, or the data are neither used nor needed. The large majority of the 39 respondents indicated a current use or a need for each of the seven data types.

Other key points to note:

- Commodity data (30 respondents) and origin/destination data (23 respondents) were used most commonly. Fewer than half the respondents used the other types of data.
- The lowest use was reported for data on terminal and intermodal transfer facilities (six respondents). However, this category also represented the greatest need, at 21 respondents.
- Data on shipments (18 respondents) and routing (16 respondents) were next most commonly cited as needs. The fewest needs were recorded for commodity data (three respondents).
- Cross-border data (nine respondents) and cargo data (six respondents) were the data types most commonly cited as not being applicable. Origin/destination data (one respondent) and commodity data (two respondents) were least commonly cited, corresponding to common usage and need.

Section 3 asked about data for modes other than trucks. Although the focus of this Synthesis is on truck surveys, the inclusion of these other modes—rail, air, water, intermodal, and pipeline—provides both a context for this focus (i.e., in identifying respondents' modal interests) and completeness (i.e., because the other modes may influence or be influenced by trucking). Table 13 indicates that although highway/truck planning dominates in respondents' planning activities (36 of 39 responses), other modes—rail (29), marine (22), and air (21)—also figure in planning activities. Intermodal and multimodal freight also was important, at 25 responses. Pipeline freight was cited once.

The next four tables describe the data needs for each mode in turn.

Table 14 describes highway/truck data needs. Count data were used most commonly, at 33 citations, followed by vehicle size (26) and vehicle type (23). Other characteristics about the vehicle, its cargo and the trip also were used. Costs were not commonly used, although the need for these data was cited, with freight rate data at 17 citations and line-haul costs at 16 citations. More important among the needs were travel time reliability (21 citations), truck origin/destination patterns and number of stops (19 each), travel time (18), and trip origin/destination patterns (17). Almost the same numbers of respondents who reported the need for a type of data did not need the data—notably, vehicle emission data and cost data.

Table 15 summarizes the requirements for rail freight data. Origin/destination patterns and commodity data were used most commonly, at 20 citations each. For the remainder of the data types, the needs generally and often significantly exceeded the uses: stop/delay data (17 responses), routing data, travel time, and reliability (16 each), and ramp-to-ramp costs and freight rate (15 each) were the most common needs.

Table 16 lists the freight data requirements for air. Commodity and shipment data were most commonly used (11 responses each), followed by origin/destination patterns (seven) and routing data (five). Origin-destination patterns (13 responses) and routing, travel time, and reliability data (12 responses each) were the most commonly cited needs.

Table 17 lists the data requirements for marine freight. Commodity data were used most frequently, at 19 citations, followed by origin/destination patterns (13), shipment data (12), and equipment data (10). The most common data needs were for reliability and port-to-port costs (10 citations each), followed by travel time (9).

Finally, respondents were asked separately about intermodal data uses and needs. Table 18 indicates that, by far, intermodal data for combinations of trucks and other modes were used or needed, with the truck/rail combination eliciting 29 responses, followed by truck/marine (24) and truck/airport (21). The rail/marine combination elicited 21 responses.

TABLE 10
DATA AVAILABILITY TO THE PUBLIC OR TO EXTERNAL AGENCIES

	Roadside/ intercept surveys	Telephone	Mail-out/ mail-back	Combined telephone/ mail-back	Commercial vehicle trip diary surveys	Internet surveys	Personal interviews	Focus/ stakeholder groups	GPS vehicle tracking surveys	License plate match – manual	License plate match – electronic	Admini-strative	Other	Total
Yes—No Charge	18	9	8	5	1	4	9	11	3	1	3	2	3	77
Yes—At a Price	0	0	0	1	0	0	0	0	0	0	0	0	0	1
Not Available	5	2	3	0	1	0	4	3	0	1	0	0	1	20
Total	23	11	11	6	2	4	13	14	3	2	3	2	4	98

TABLE 11
DATA DISSEMINATION

	Roadside/ intercept surveys	Telephone	Mail-out/ Mail-back	Combined telephone/ mail-back	Commercial vehicle trip diary surveys	Internet surveys	Personal interviews	Focus/ stakeholder groups	GPS vehicle tracking surveys	License plate match – manual	License plate match – electronic	Admini-strative	Other	Total
Hardcopy (may also include presentation)	14	7	8	4	1	3	11	10	2	1	3	2	3	69
Electronic Data File	17	9	6	4	2	3	10	9	3	1	3	2	4	73
Summary Only	3	0	0	1	0	0	0	0	0	0	0	0	0	4
Discussion	0	2	1	0	0	0	1	0	0	0	0	0	0	4
Online Report/ Website	0	0	0	0	0	0	0	1	0	0	0	0	0	1
Study Not Yet Complete	0	1	0	0	1	0	0	1	0	0	0	0	1	4
Other (not other-wise identified)	0	0	0	0	0	0	0	1	0	0	0	0	0	1
Total	34	19	15	9	4	6	22	22	5	2	6	4	8	156

TABLE 12
FREIGHT DATA USED OR NEEDED

Freight Data	Currently Use	Need But Not Available	N/A (do not use or need)
Commodity detail (e.g., formal classification system)	30	3	2
Cargo detail (e.g., aggregate categories, hazardous and nonhazardous cargo, empty vs. non-empty)	18	10	6
Origin-destination detail (e.g., states, ZIP codes, counties, shipper detail, traffic analysis zone, customs port of exit/entry)	23	10	1
Shipment detail (e.g., weight, volume, value, mode of transport, average length of haul, number of stops per trip, time-sensitive shipment, truckload or less-than-truckload shipments, empty shipments)	13	18	4
Routing details (e.g., major routes used, number of stops, interim trip origin and destinations, vehicle routing, hazardous materials vehicle routing)	13	16	5
Cross border data (e.g., origin/destination patterns, commodity, vehicle type, shipment characteristics, mode, stop/delay data)	15	10	9
Terminal and intermodal transfer facilities (e.g., truck volumes entering/exiting, congestion-related delays on access roads, length of queue on access roads, incident rates on access roads, travel time contours around the facility, capacity of facility)	6	21	5

TABLE 13
MODES CONSIDERED IN PLANNING

Mode	Responses
Truck/Highways	36
Rail	29
Air	21
Water (marine port, barge, short sea shipping, ferry)	22
Intermodal/Multimodal	25
Other (pipeline)	1

Respondents described their needs for intermodal data. Although some had data that covered certain (though not all) characteristics of each mode, such as origin, destination, volume, and counts, the full multimodal profile and the details of the intermodal transfer were lacking. One respondent expressed these gaps as "upstream origin, downstream destination, transfer time, transfer cost, commodity, shipment details, intermodal facility location, and operation time. [Origin-destination information] for intermodal freight is often available for individual links, but not for the complete intermodal trip." Other specific needs were intermodal move counts; number of container/trailer lifts; commodity tonnage (weight), type, and value; routing (for all modes); and characteristics of dray trips, including local activity.

In addition, respondents wanted activity measured for and differentiated by facility and non-facility cargo and vehicles. They wanted up-to-date data that could be available in different measures, such as short tons and TEUs (twenty-foot equivalent units). Finally, one respondent noted that much of the data must come from the private sector, which would incur additional cost.

USE OF EXISTING DATA SETS

Section 4 of the survey asked respondents to review a list of 21 public and commercial (private) American data sets that covered the major freight modes (truck, rail, marine, and air). The purpose was to determine which of these existing sources, external to the respondents' organizations, were used; that is, as a possible alternative to in-house data collection. Respondents also were asked to assess the data sets that they used.

Thirty-five respondents indicated that they used these external data sets to "populate [their] freight databases." Table 19 shows the usage of the 21 public and commercial data sources. The most frequently used data set was the Freight Analysis Framework (U.S.DOT, 33 responses), followed by the U.S. Commodity Flow Survey (31) and TRANSEARCH Insight Database (25).

Table 20 describes the purpose for using the public and commercial data sets. The most common purpose was for infrastructure/facility planning (30 responses), followed by demand management (14), traffic safety and operations (10), and land use planning and logistics planning (9 each). There were also several "other" purposes, which comprised policy development, long range planning, corridor planning, project planning, modeling (including model updates), market research, cost benefit analysis, commodity flow analysis, freight statistics and studies.

TABLE 14
HIGHWAY/TRUCK FREIGHT DATA USE AND NEEDS

Data Type	Currently Use	Need But Not Available	N/A
Vehicle Type	23	6	7
Vehicle Size	26	5	5
Average Vehicle Speed	16	9	11
Vehicle Emission Data	6	15	14
Traffic Counts and Classification Data	33	1	2
Cargo Type	19	10	5
Payload Weight	15	11	8
Shipment Value	12	13	8
Truck O/D Patterns	15	19	1
Trip O/D Patterns	16	17	1
Travel Time	11	18	6
Travel Time Reliability	5	21	10
Number of Truck Stops for LTL Shipments	0	19	15
Incident Data	17	7	11
Line-haul Costs	3	16	15
Drayage Costs	4	14	16
Freight Rate (e.g., cost per ton-mile)	4	17	13
Other	2	1	12

N/A = not available, O/D = origin/destination.

TABLE 15
RAIL FREIGHT DATA USE AND NEEDS

Data Type	Currently Use	Need But Not Available	N/A
O/D Patterns	20	9	0
Commodity	20	9	0
Equipment Details (e.g., car type)	12	11	6
Shipment (e.g., weight, volume, value)	11	12	6
Routing Data	9	16	4
Travel Time	4	16	9
Reliability	2	16	10
Stop/Delay Data	2	17	10
Ramp-to-ramp Costs	1	15	13
Freight Rate (e.g., cost per ton-mile)	4	15	10
Other	0	3	10

N/A = not available, O/D = origin/destination.

TABLE 16
AIR FREIGHT DATA USE AND NEEDS

Data Type	Currently Use	Need But Not Available	N/A
O/D Patterns	7	13	1
Commodity	11	11	0
Shipment (weight, volume, value)	11	8	1
Routing Data	5	12	4
Travel Time	2	12	6
Reliability	2	12	6
Air Freightage	1	11	8
Drayage Costs	2	11	7
Freight rate (e.g., cost per ton-mile)	1	11	8
Other	1	6	8

N/A = not available, O/D = origin/destination.

TABLE 17
MARINE FREIGHT DATA USE AND NEEDS

Data Type	Currently Use	Need But Not Available	N/A
O/D Patterns	13	5	4
Commodity	19	3	0
Equipment Details (e.g., vessel type)	10	4	7
Shipment (e.g., weight, volume, value)	12	6	3
Routing Data	7	7	7
Travel Time	5	9	8
Reliability	4	10	8
Port-to-port Costs	4	10	8
Drayage Costs	6	7	8
Freight Rate (e.g., cost per ton-mile)	6	8	7
Other	7	4	8

N/A = not available, O/D = origin/destination.

TABLE 18
INTERMODAL FREIGHT DATA USES AND NEEDS

Intermodal Combination	Responses
None	2
Truck/Rail	29
Truck/Airport	21
Truck/Marine Port	24
Rail/Marine Port	21
Rail/Airport	11
Other	2

Table 21 describes the perceived shortcomings of the data. The most commonly cited shortcoming in several data sets was insufficient detail or inappropriate scale (25 respondents). Other common shortcomings included high cost (21 respondents), incomplete coverage of freight mode, movement, or commodity that is carried (19), datedness of the data (17), and small sample size and incomplete geographical coverage (16 responses each). Eight respondents noted that the data had been developed for another purpose and were not adaptable, and five respondents indicated that the definitions were not applicable to their needs. Other shortcomings (one citation each) were the "headquarter effect" associated with the PIERS data (i.e., the data reflected an administrative office location, not the location of the actual freight activity), the inadequacy of the reporting tool, the use of consultant resources (i.e., the knowledge base, if not also the actual database, is not in house), and not all of the data were compiled.

TABLE 19
USAGE OF PUBLIC/COMMERCIAL DATA SOURCES

Public/Commercial Data Sources	Do You Use? Yes
Airport Activity Statistics of Certified Route Air Carriers—U.S. Bureau of Transportation Statistics	10
Border Crossing Data—U.S. Bureau of Transportation Statistics	18
Commodity Flow Survey (CFS)—U.S. Bureau of Transportation Statistics and the Census Bureau	31
Freight Analysis Framework (FAF)—U.S.DOT	33
Freight Commodity Statistics—Association of American Railroads	13
IANA Report—Intermodal Association of North America	3
Industry Trade Data and Analysis—International Trade Administration, U.S. Department of Commerce	8
LTL Commodity and Market Flow Database—American Trucking Association	5
MARAD—U.S.DOT Maritime Administration	7
Maritime Administration Office of Statistical and Economic Analysis	7
National Roadside Survey/Commercial Vehicle Surveys	4
North American Trucking Survey (NATS)—Association of American Railroads	5
Port/Import/Export Reporting Service (PIERS)—Journal of Commerce	7
Rail Waybill Sample—Surface Transportation Board	22
RAILINC—American Association of Railroads	1
State Estimate of Truck Traffic—FHWA	9
Transborder Surface Freight Data—U.S. Bureau of Transportation Statistics	10
TRANSEARCH Insight Database	25
TransStats: The Intermodal Transportation Database—U.S. Bureau of Transportation Statistics	8
Vehicle Inventory and Use Survey (VIUS)—U.S. Census Bureau (discontinued as of 2002)	8
Waterborne Commerce of the United States—U.S. Army Corps of Engineers	21

USE OF INTELLIGENT TRANSPORTATION SYSTEM TECHNOLOGIES

The potential of ITS (Intelligent Transportation System) technologies to reduce data collection costs, increase sample

size, improve data quality, and reduce intrusion and respondent burden has attracted considerable attention in the freight planning community. Section 5 of the survey examined the use of ITS for freight surveys. Twenty respondents indicated that they used ITS to collect freight data.

TABLE 20
PURPOSE FOR USING PUBLIC OR COMMERCIAL DATA SOURCES

Purpose of Use	Responses
Land Use Planning	9
Infrastructure/Facility Planning	30
Traffic Safety Operations	10
Demand Management	14
Air Quality Management	6
Logistics Planning	9
Other	9

TABLE 21
SHORTCOMINGS OF AVAILABLE DATA

Shortcomings of Available Data	Responses
Sample size/number of samples too small	16
Incomplete geographical coverage	16
Incomplete coverage of freight mode, movement, or commodity that is carried	19
Out of date	17
Insufficient detail or inappropriate scale	25
Developed for another purpose and cannot adapt to my needs	8
Cost is too high	21
Definitions not applicable to my needs	5
Other	3

Table 22 shows weigh-in-motion (WIM) technologies at 15 responses and sensors at 12 responses were the most commonly used ITS technologies, followed by automatic vehicle classification (AVC) at 9 responses. AVC and sensors had the highest potential for integration with other data collection initiatives (with 5 and 6 ratings respectively of "high" potential) followed by WIM (4 rated as "high" and 7 rated as "medium").

Six of the 20 respondents indicated that they currently link freight survey data with data from informatics such as roadway, on-board vehicle, and/or wide area sensors that can provide data on flows by mode, location, routing, and time of day. Eleven respondents did not make these linkages, two did not know, and one did not answer this question.

TABLE 22
USAGE AND QUALITY OF ITS TECHNOLOGIES

	Do You Use?	What Is the Potential for Integration with Other Data Collection Initiatives?		
ITS Technology	Yes	High	Medium	Low
Advanced video image processing	2	1	0	1
Aerial videos	2	1	1	1
Automated vehicle classification (AVC)	9	5	2	2
Automatic vehicle identification (AVI) technologies	2	0	1	2
Automatic vehicle location (AVL) system	1	0	0	1
Cellular phone coordinates (probe vehicles)	2	1	1	1
Closed-circuit cameras (CCTV)	4	0	3	2
Electronic toll collection equipment	4	0	3	2
Environmental sensor stations	1	0	1	1
Global positioning system (GPS) equipment	3	1	1	0
License plate matching systems	4	2	1	2
Radio frequency identification	0	0	0	1
Smart cards	1	0	1	1
Vehicle tracking and navigation systems (VT&NS)	1	1	0	1
Weigh-in-motion (WIM) technologies	15	4	7	1
Sensors (e.g., loop detectors, acoustic sensors, infrared sensors, and radar/microwave sensors)	12	6	4	2

Respondents expressed both benefits to linking freight survey data with data from informatics and barriers to making these linkages. Table 23 lists the benefits. It should be noted that all respondents found some benefit to making these linkages. There were 10 citations each in having the benefit of improved data validation/quality control, increased accuracy and data quality, and more comprehensive data. Nine respondents cited greater cost-effectiveness in data collection, eight noted the reduced time between data collection and their availability, and six noted a reduced need for surveys and other data collection. Finally, there was one citation each of the benefit accruing from having the informatics

data support planning efforts for surveys, getting a "bigger picture of what is moving," and allowing for off system data collection.

TABLE 23
BENEFITS OF LINKING FREIGHT SURVEY DATA WITH DATA FROM INFORMATICS

Benefit	Responses
No benefits	0
More cost-effective data collection	9
Reduced need for surveys and other data collection efforts	6
Improved data validation/quality control	10
Increased accuracy/quality of data	10
More comprehensive data	10
Reduced delay between time of data collection and when available for analysis	8
Other	3

Table 24 lists the barriers to linking freight survey data with data from informatics. Fifteen respondents cited an insufficiency of capital resources to build the informatics infrastructure, and this was common to several data sets. An insufficiency in technical knowledge was cited 8 times, and a lack of standards for design and operations was cited 7 times. Other barriers (cited once each) were insufficient staffing, insufficient agency coordination, reluctance on the part of key partners to participate (in this case, a terminal operator), and a combination of lack of funds, internal information technology limitations, and institutional issues.

TABLE 24
BARRIERS TO LINKING FREIGHT SURVEY DATA WITH DATA FROM INFORMATICS

Barrier	Responses
Insufficient capital resources to build the informatics infrastructure	15
Insufficient technical knowledge to implement or operate informatics	8
Lack of standards for design and operation	7
Insufficient staffing	4

Finally, one agency noted that it was planning to use more informatics. However, another noted some practical limitations with the use of ITS data: "there [are] limited ITS data OR the quality is too low for the purpose of planning (i.e., Weigh-In-Motion data)," and a third respondent noted that "additional Weigh-In-Motion equipment would be helpful, but [the] technology has not met field condition requirements."

USER ASSESSMENT OF DATA

Section 6 of the survey asked respondents to assess their data, whether sourced in-house or from external public or commercial databases. Respondents were also given the opportunity to comment extensively in their assessments. The results are summarized here.

Assessment of Freight Data

Table 25 summarizes respondents' assessments of how well their freight data met their needs, which were expressed in six categories. The table also notes the applicability of the data to their activities. Key findings were as follows:

- Each of the six categories was applicable to respondents' needs, albeit to different degrees. Forecasting was the most applicable, at 37 citations (and four other respondents indicated that this category was not applicable). Investment decision making (31 citations), cost-benefit analysis (30), and operational analysis (26) were next, followed by design and environmental assessment (18 each).
- Most respondents indicated that the data met the needs adequately (63 citations). A smaller number indicated that the needs were met poorly (46 citations) or "good" (36 citations). Eight described their needs as being met poorly (three for cost-benefit analysis) and seven described the data as being "very good" in meeting the needs.

Needed Improvements

Table 26 lists the improvements that respondents believed were needed to address current deficiencies and gaps. The respondents ranked the listed improvements on a scale of 1 to 5 (most important to least important). The two most important improvements identified were to provide more detail (17 responses) and ensure that data are collected regularly (14 responses). Other most important improvements included the collection of data that were not otherwise collected, ensuring the timeliness of the data ("[should not use] 2002 and 2005 data to make decisions in 2009, 2010 and 2011"), and management commitment and availability of capable staff.

Respondents also identified several benefits to having these improvements. Thirty respondents indicated that these improvements would provide them with new capabilities, and 24 expected to benefit from improved productivity. (Respondents were allowed to provide multiple answers to this question.) Other specific improvements comprised better decisions and investments, faster identification of trends, better informed planning process, data that represent "what is moving," [the identification of] economic opportunities, and more accurate freight counts and fees (one citation each).

TABLE 25
ASSESSMENT OF HOW WELL NEEDS ARE MET BY FREIGHT DATA

	Applicable to Your Activities?		Degree to Which Your Needs Are Met?				
User Need	Yes	No	Very Good (exceeds your requirements)	Good	Adequate	Poor	Very Poor (not usable for your requirements)
Forecasting	37	4	2	9	16	9	1
Cost-benefit Analysis	30	7	2	9	9	8	3
Operational Analysis	26	8	0	6	10	8	2
Design	18	11	2	1	8	5	1
Environmental Assessment	18	10	1	2	6	7	0
Investment Decision Making	31	5	0	9	14	9	1

Note: Responses from two different offices at the California DOT were included in this table.

TABLE 26
IMPROVEMENTS NEEDED TO ADDRESS DEFICIENCIES OR GAPS

	Frequency of Rank of Importance				
Improvement	1 (most important)	2	3	4	5 (least important)
Expand Sample Size	5	9	3	8	8
Expand Coverage	5	3	13	5	6
Expand Modes	8	3	8	7	6
Provide More Detail	17	9	2	4	4
Ensure Data Are Collected Regularly	14	9	3	5	2
Other	4	0	0	0	1

Note: Responses from two different offices at the California DOT were included in this table.

Success Factors in Data Collection

Respondents identified several factors for success in their collection of freight data:

- Adequacy of funding was the most dominant theme. Funding was needed "to pay for a sophisticated freight forecast product. Most MPOs do not have the resources." One respondent noted that freight data are "highly desired," so it has been able "to pay for what is out there."
- Prior knowledge and experience in the subject were cited as success factors, including "knowledge of survey techniques [and] knowledge of freight market" and "many years of experience in this type of data collection, analysis and reporting."
- Appropriate planning of the data collection effort, clarity in objectives ("focus on what problem needs to be solved"), clarity "in the questions that can be answered," and "asking the right questions."
- Effective communications and "relationships" with the survey participants.
- "Willingness" of participants (in this case, terminal operators) "to release accurate information" and obtaining much needed private data to fill gaps.
- Adequacy of the responses from the survey participants. Also important was the "interest in the [freight] community."
- Level of specifics and detail in the responses.
- Experience of the data collection team.
- Timeliness and currency of the data: "freight information needs to be current due to the rapidly changing economic conditions."

Expansion and Extension of Existing Data Collection

Table 27 lists respondents' interest in expanding or extending existing data collection, and also the priorities they assigned to these plans. With the exception of traffic counts (28 citations), such plans were in the minority, although there was strong interest in expanding personal interviews (16 citations, compared with 17 that were not being expanded or extended), focus and stakeholder groups (17 and 19 respectively) and GPS vehicle tracking (11 and 16 respectively).

TABLE 27
INTEREST IN EXPANDING OR EXTENDING EXISTING DATA COLLECTION

	Is the Existing Data Collection Effort Being Expanded?		If Yes, Please Indicate Level of Priority		
Type of Survey/Data	Yes	No or N/A	Low	Moderate	High
Roadside/Intercept Survey	9	27	2	4	5
Combined Telephone Mail-out/ Mail-back Survey	6	25	0	3	2
Telephone Survey	5	25	2	2	1
Mail-out/Mail-back Survey	5	24	2	3	0
Personal Interviews	16	17	4	7	2
Internet Surveys	4	23	2	3	1
Focus and Stakeholder Groups	17	19	3	6	6
Administrative Data (e.g., insurance records)	3	23	1	0	1
Commercial Vehicle Trip Diaries (e.g., trip logs)	5	22	2	1	2
GPS Vehicle Tracking	11	16	4	3	3
License Plate Match—Manual	4	23	3	2	0
License Plate Match—Electronic	3	23	2	0	0
Traffic Counts	28	10	3	13	7

Problems with Existing Data and Most Important Improvements

Respondents were asked to list the main problems with their existing data and to indicate what they saw as the most important improvements needed. The following were key points:

- Greater detail and disaggregation of existing data: "Commodity data from [Bureau of Transportation Statistics] or [TRANSEARCH are] at too high a level." There is "no level of detail for an area the size of a [metropolitan region]." "Need zip code or [traffic analysis zone] level of data." "Would like more detailed O-D [information]." "Need for … more specific data." "[Need] greater geographic detail."
- Improved coverage and "much bigger sample size"
- Improved response rates
- More timely, up-to-date data. "Public data, like FAF2, [are] too old."
- Origin-destination data
- Travel delay data
- Routing data—"not just shortest path."
- "Capacity to capture the data. [State DOT does not] have the staff or capacity and [so the State DOT uses] consultants which are too costly." "Need some dedicated staff working on data." "The main problems with existing data [are] knowing what information is provided in the source and also having the staff with the expertise to utilize the data."
- Cost relative to benefits: "why pay for large surveys when there are very limited funds to invest?"
- Data quality. One respondent cited the potential for underreporting as a problem: "The data [are] self-reported by terminal operators through an honor system. There is the potential for underreporting as harbor fees are associated [with] freight movement."
- Irregularity of data collection and data gaps.

One respondent compared different levels of data and listed the associated difficulties: "Facility operation data [are] collected internally and [are] generally of high quality, but [are collected] too infrequently due to budget constraints. In contrast, regional and national data [are] not satisfactory for many purposes, especially intra-regional/ local freight flows and characteristics. Data access restrictions due to bureaucracy. Little consistency in data formatting makes [them] difficult to process. Would welcome open platform for data sharing." Another respondent encapsulated the complexity of the needs by noting that the data are "not current, not geographically detailed or [temporally] detailed, no historical trend [information] on change and paradigm shifts, expensive to collect, difficult to repurpose, inevitably not what you need but what you have."

Technical and Content Problems and Limitations

Respondents addressed a series of technical and content problems and limitations that they experienced with previous surveys, and described how they planned to address

them in future surveys. Seven categories were specified in the survey; the findings are summarized here:

1. *Problems of precision. Responses*: hiring the "best consultants" to assist "on the forecast," requiring better calibration of data collection equipment, increased funding, better training of temporary staff "to ensure accuracy of data," standardized survey instruments, use of current technology, and working with another public agency to secure the required data (in this case, ship manifests).

2. *Problems of confidentiality.* Responses: increase funding to "buy better [information]," focus only on the data that are "essential" and "stop wasting ... time and money on data that the industry doesn't support in [these] settings," work with data "owners ... to change restrictive policies when confidentiality can be assured," assure confidentiality to respondents, and, explain the cost [i.e., the implications] to the governing legislature.

3. *Problems of misunderstood survey questions.* Responses: explaining the "benefit" of the surveys in ways that are meaningful to respondents, develop "better" plans for surveying ("in-house surveying? Contract ... QUALIFIED data collectors."), improve questions on mail-out and internet surveys, use a consultant to develop the survey, conduct pilot tests, provide assurance that the agency "will aggregate the data [so as not to] reveal information about their company but they are still concerned about sharing the information," improved staff training ("train the trainer"), provide capabilities in multiple languages, provided "detailed and helpful route graphics," and modify questions.

4. *Problems of unintended applications.* Response: need to address "translation and cross cultural challenges."

5. *Problems of malfunctioning equipment.* Responses: experimenting with image data collection, rapid repairs, and responses.

6. *Problems of low response rates.* Responses: consider more concise surveys, compose better cover letters, provide incentives, allow "multiple avenues for response, e.g., internet, 800 telephone number," use multilingual survey instruments, reduce survey duration, follow up with telephone calls (to address low response "in rural areas"), increase funding and hire a better consultant.

7. Other problems. (This category allowed respondents to identify specific issues not otherwise addressed.) Responses: "some potential respondents who agreed to be interviewed for the survey initially, refused to take the survey later on. A proper [redress] of their questions/concerns can improve sample size," need to address "concerns about how the data will be used and revealed to the public."

Legal and Confidentiality Issues

Finally, respondents were asked to describe how legal and confidentiality issues have impacted the design and conduct of their surveys, and steps they have taken to address these issues. The challenges comprised—

- The level of detail for [analyzing or presenting] origin-destination and commodity information is impacted by confidentiality concerns.
- Some participants (motor carriers) are unwilling to share information, such as that regarding commodities.
- Attempts to expand exemption of the completed surveys from the Freedom of Information Act have been unsuccessful.
- Use of [some] proprietary data can be limited by confidentiality constraints.
- Surveyors at international border crossings were prohibited by border and customs staff from conducting interviews in the queues (meaning that another survey method had to be found).

Solutions to these challenges comprised—

- Inclusion of a legal review with all (of one respondent's) surveys.
- Development of appropriate wording regarding legal and confidentiality conditions: "Increases [the] time to develop contracts, but have found that challenges are not prohibitive."
- Avoidance of the "level of detail" [in surveys] that would generate legal and confidentiality problems.
- Conduct of all correspondence with survey participants via a third-party customer service center—in this case, with electronic toll tag owners.
- Continued strengthening of the relationship with customers "to create trust."
- Not collecting addresses.
- Allowing for voluntary participation in the survey.

CHAPTER FOUR

CASE STUDIES

INTRODUCTION

This chapter presents case studies for several types of surveys. The presentation complements the findings of the practitioners' survey that were described in chapter three with details of actual surveys and their characteristics. The details are taken from material provided by practitioners and from the literature. In addition, the last section presents a comparison of surveys from the literature.

It should be noted that the surveys are presented in two ways, depending on the type of survey and on the availability of source material. Case studies are presented individually for some survey types, and in others surveys are combined in order to exemplify specific points. In all cases, for a given survey type each of the surveys included presents a different aspect or variation.

ROADSIDE/INTERCEPT SURVEYS

Statewide Truck Lanes Needs Identification Study—Georgia

The Georgia Department of Transportation (GDOT) conducted a series of roadside origin-destination surveys in 2006 as part of a statewide study to identify the need for truck lanes. The surveys were conducted at eight weigh stations along high-volume truck Interstate highways. The locations were also selected to provide a geographic distribution across the state, and to avoid duplication with a similar survey that was conducted just prior to the GDOT surveys by the Atlanta Regional Council (ARC) in and around the Atlanta metropolitan area. Surveys also were conducted at two gates to the Port of Savannah, given the high volume of truck traffic to and from that area.

Twenty-four hour counts were conducted at the same time as the surveys. These were used as the basis for expanding the samples at each site. A total of 3,636 trucks was sampled at the 10 sites: these represented between 4.0% and 15.8% of the daily truck volumes at the weigh station sites and 14.9% and 18.3% at the Port of Savannah gates.

The GDOT survey was based on the ARC survey in order to further coordinate efforts and facilitate the sharing of survey results. Some modifications were made to address the specific requirements of the GDOT truck lanes study, and to capture data on commodity type and category. The collected data comprised—

- Vehicle information: number of axles, number of units, truck configuration, trailer style, hazardous materials status, and state of registration.
- Trip information: origin, destination, frequency, roads use, purpose, origin facility type, destination facility type, load status, commodity type, routing decision-maker (who chooses the route), and load type/vehicle ownership.

A shorter questionnaire was used for the two Port of Savannah surveys to expedite data collection and to allow for localized differences in truck origin-destination patterns. Some port-specific questions also were included.

Of particular note is the use of a PDA for both surveys. The PDA allowed for direct entry of the data into an electronic database and the automatic data coding. This reduced costs by avoiding manual data entry and coding and increased accuracy by reducing the likelihood of key entry errors after the fact.

The survey had four types of questions:

- Choose one (e.g., the location at which the survey was conducted)
- Choose multiple (e.g., trailer style)
- Text entry (e.g., description of the location at which the trip originated)
- Numeric entry (e.g., number of axles).

Figure 2 presents example of these questions. Note that some of the questions require input from the driver and others are based only on the interviewer's observations (*4*).

Portland Freight Data Collection Program—Port of Portland et al.

In 2005, a comprehensive freight data collection program was initiated in the metropolitan Portland, Oregon, region. The data were collected on behalf of the Port of Portland, the Oregon Department of Transportation, the Washington

State Department of Transportation, and Portland Metro (the region's MPO). Roadside intercept surveys were conducted at nine external gateways (highways) to the region, rest areas, weigh stations, and truck inspection locations. Truck counts were conducted in order to allow for expansion of the data.

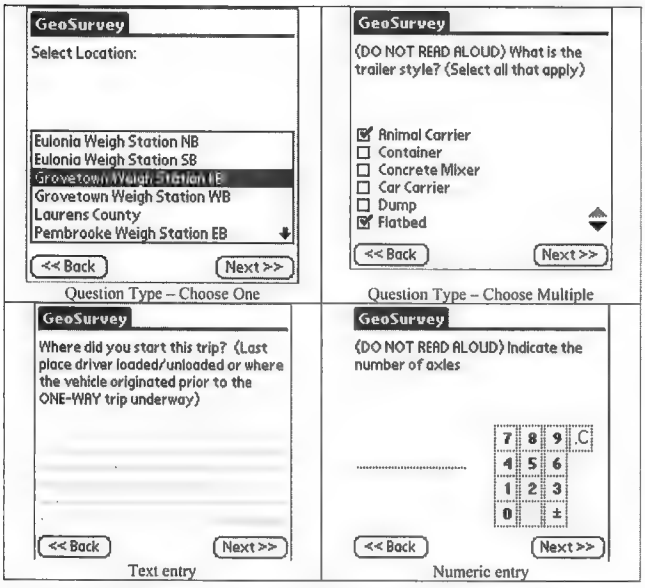


FIGURE 2 PDA questions—Georgia DOT. [*Source*: *Statewide Truck Lanes Needs Identification Study, Technical Memorandum 1: Data Collection (4).*]

The surveys collected data on truck type, cargo type, cargo weight, trip origin and destination, facility type at origin and destination, location of the truck's home base, activity at the origin and destination (i.e., pick up, delivery, or return to base), carrier type, and whether the vehicle had a WIM transponder. The survey also asked about the highways used during the sampled trip, including the interchanges and access roads between the highways and the origin and destination (*5*, *6*). Figure 3 shows the survey form. Figure 4 shows a variation of the form that was used for roadside interviews at entrances to key freight terminals in the region. The form was administered to drivers at marine and rail terminals, tank farms, and pipeline terminals.

Commercial Vehicle Survey—Ontario, Canada

The Ministry of Transportation of Ontario, Canada, has conducted a large-scale truck roadside origin-destination survey at approximately 5-year intervals since 1978. The surveys are conducted on provincial highways and at inspection stations, rest stops, and interprovincial and international (U.S.) border crossings. They focus on inter-urban trips. The surveys have collected information on carrier information; vehicle type, number of axles, and weight; trip origin and destination; and commodity type and value (*9*). The survey focuses on heavy trucks, so other commercial vehicles are not captured. Intraurban travel also is not captured.

In 1999–2001, the National Roadside Survey (NRS) was conducted across Canada. This nationwide truck survey comprised the aforementioned Ontario survey, as well as surveys in other provinces and at U.S. border crossings. A selection of intermodal terminals also was surveyed. The NRS was a cooperative effort among the federal and provincial ministries of transportation as well as the FHWA (with respect to the border crossings). Approximately 65,000 trucks were surveyed at 238 data collection sites.

The NRS provides a proven example of a nationwide program for collecting inter-urban truck traffic, one that could be followed in the United States. A consistent survey form, a common general surveying procedure, and common classifications and terms were developed and used across the country. However, although driver interviews were conducted by local staff who were familiar with local travel and vehicle characteristics, some variations in the data collection were observed. Different groups having different objectives (e.g., enforcement, planning, and policy development) gathered the data. This reflected each province's interest in participating in the NRS. However, as a result of these different interests, there was some variation in the focus of the interviews: some focused on vehicle weight and dimensions, which are important for enforcement, and others focused on trip details, which are important for planning. Although these differences must be captured, local nuances must be captured in a "well-planned and consistent manner when national data for a wide range of uses are collected" (*10*). A further complication arose in the expansion of the 1999–2000 NRS data, whereby the provinces of Ontario and Québec and the federal ministry of transportation each used a different method. This means that the resultant travel characteristics and trip tables may differ for the same location, depending on whose expansion method is used.

Data from a 2005–2007 update to the NRS currently are being analyzed. Although direct data entry has been in place since the 1995 survey, this survey incorporated a GIS-based routing component that enabled the surveyor to confirm the route with the driver and, if necessary, to modify it in order to get an accurate profile of the highways used for the trip. The 1999–2001 NRS asked drivers to list the highways used in the trip: this information was used to confirm the route during the data processing stage (*11*).

ROADSIDE/INTERCEPT SURVEYS—SPECIFIC TOPICS

It is important to note that some roadside/intercept surveys, although following the general format of the aforementioned surveys, focus on specific geographical areas and issues. As a result, the types of questions may vary from the general format, with greater or lesser focus on specific types of data.

Portland Region Roadside Intercept Truck Survey Form

Survey Date:_____
Survey Location:_____
Interviewer:_____
Time of interview:_____

Interview Questions:

Last Stop Where Pickup or Delivery was Made

1. City/State:_____
2. Street Address (if in Oregon or Washington):_____
3. Facility Type: *Factory, Warehouse/Dist. Center, Truck Terminal, Rail Yard, Port, Airport, Retail Outlet, Farm, Mine, Home Base, Other (specify)*_____
4. Activity at Last Stop (circle one): *Pickup* *Delivery* *Return to Base*

Routing – Last Stop (if it is in Oregon or Washington)

5. Which major routes did you use (circle all that apply):
   I-5 I-84 I-205 US 26 US 30 OR 99W OR 99E OR 217
   *OR 224 OR 212 OR 213 WA 14 Other (specify):*_____
6. Which entrance ramp did you use?_____
7. Which access roads did you use to get to the freeway?

Next Stop Where Pickup or Delivery will Be Made

8. City/State:_____
9. Street Address (if in Oregon or Washington):_____
10. Facility Type: *Factory, Warehouse/Dist. Center, Truck Terminal, Rail Yard, Port, Airport, Retail Outlet, Farm, Mine, Home Base, Other (specify)*_____
11. Activity at Stop (circle one): *Pick up* *Delivery* *Return to Base*

Routing – Next Stop (if it is in Oregon or Washington)

12. Which major routes will you use (circle all that apply):
    I-5 I-84 I-205 US 26 US 30 OR 99W OR 99E OR 217
    *OR 224 OR 212 OR 213 WA 14 Other (specify):*_____
13. Which Exit Ramp will you use:_____
14. Which access roads will you use to get to the final destinations?

Cargo Information

15. Is the truck (circle one): *Empty* *Fully Loaded* *Partially Loaded*
16. Is this truck loaded with (circle one): *Single Commodity* *Mixed Goods*
17. If single commodity, describe:_____
18. If mixed, what is primary good:_____
19. If empty, what is the most common commodity carried by this truck:_____
20. What is the cargo weight:

Home Base Information

21. What is the location of this truck's home base? City/State: Zip code:

Carrier Type

22. Is this truck (circle one): *for hire* *private fleet*
23. If for hire, does this truck carry: *one company's goods* *more than one company's goods*
24. Does this truck have a weigh-in-motion transponder? *yes* *no*

For surveyor use only

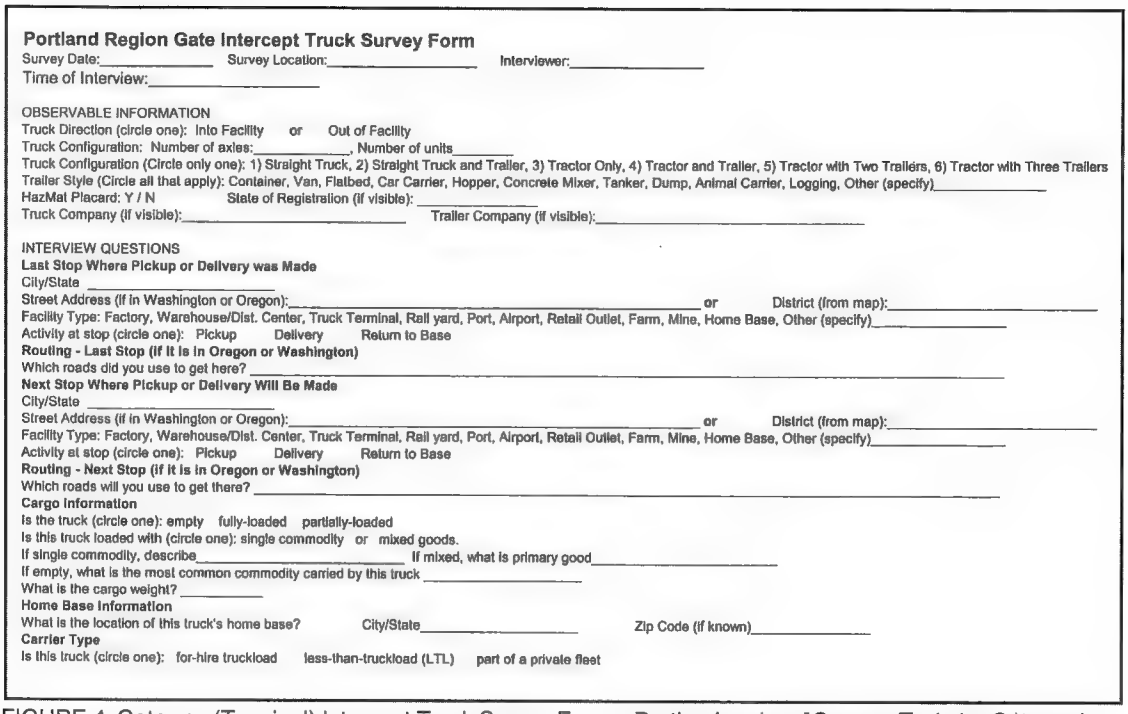
Truck Configuration: Number of axles:_____Number of units:_____
Circle one:

1. Straight truck	*2. Straight Truck and Trailer*	*3. Tractor Only*
4. Tractor and Trailer	*5. Tractor with 2 Trailers*	*6. Tractor with 3 Trailers*

HazMat Placard: Y / N Truck Company (if visible):_____
State of Registration (if visible):_____Trailer Company (if visible):_____
USDOT No.:_____

FIGURE 3 Roadside Intercept Truck Survey Form—Portland region. [*Source*: *Roadside Intercept Survey (7)*.]

For example, some studies have examined drayage activity at marine ports. Drayage refers to local movements between a port and its surrounding urban area (i.e., local transportation within the urban area). Because the dray trucks operate primarily in an urban environment, they can have a significant impact on congestion and air quality (*12*). A 2001 study surveyed truck drivers entering and exiting the Port of Los Angeles/Port of Long Beach. The survey solicited information about the truck type, the type of origin or destination (off-dock, intermodal facility, industrial facility or warehouse, another port terminal, other), the location of the origin or destination, and the specific streets and freeways that were used for the trip. Traffic counts were collected at the same time. Approximately 10,000 surveys were distributed, and 3,300 of these (33%) were returned (*13*). A 2008 study of drayage at the Port of Houston gathered similar information to the aforementioned survey, but also asked about trip distance (average length of drayage haul), the frequency of trips on a typical day, location of "worst traffic" along the route, cause of delay, use of a toll facility, average wait time (idle time) entering the Port (Barbours Cut Terminal), and the actual wait time for the current trip. Demographic information and vehicle characteristics (age and total mileage) also were gathered (*12*).



Portland Region Gate Intercept Truck Survey Form

Survey Date:_____ Survey Location:_____ Interviewer:_____
Time of Interview:_____

OBSERVABLE INFORMATION
Truck Direction (circle one): Into Facility or Out of Facility
Truck Configuration: Number of axles:_____, Number of units_____
Truck Configuration (Circle only one): 1) Straight Truck, 2) Straight Truck and Trailer, 3) Tractor Only, 4) Tractor and Trailer, 5) Tractor with Two Trailers, 6) Tractor with Three Trailers
Trailer Style (Circle all that apply): Container, Van, Flatbed, Car Carrier, Hopper, Concrete Mixer, Tanker, Dump, Animal Carrier, Logging, Other (specify)_____
HazMat Placard: Y / N State of Registration (if visible): _____
Truck Company (if visible):_____ Trailer Company (if visible):_____

INTERVIEW QUESTIONS
Last Stop Where Pickup or Delivery was Made
City/State _____
Street Address (if in Washington or Oregon):_____ or District (from map):_____
Facility Type: Factory, Warehouse/Dist. Center, Truck Terminal, Rail yard, Port, Airport, Retail Outlet, Farm, Mine, Home Base, Other (specify)_____
Activity at stop (circle one): Pickup Delivery Return to Base
Routing - Last Stop (if it is in Oregon or Washington)
Which roads did you use to get here? _____
Next Stop Where Pickup or Delivery Will Be Made
City/State _____
Street Address (if in Washington or Oregon):_____ or District (from map):_____
Facility Type: Factory, Warehouse/Dist. Center, Truck Terminal, Rail yard, Port, Airport, Retail Outlet, Farm, Mine, Home Base, Other (specify)_____
Activity at stop (circle one): Pickup Delivery Return to Base
Routing - Next Stop (if it is in Oregon or Washington)
Which roads will you use to get there? _____
Cargo Information
Is the truck (circle one): empty fully-loaded partially-loaded
Is this truck loaded with (circle one): single commodity or mixed goods.
If single commodity, describe_____ If mixed, what is primary good_____
If empty, what is the most common commodity carried by this truck _____
What is the cargo weight? _____
Home Base Information
What is the location of this truck's home base? City/State_____ Zip Code (if known)_____
Carrier Type
Is this truck (circle one): for-hire truckload less-than-truckload (LTL) part of a private fleet

FIGURE 4 Gateway (Terminal) Intercept Truck Survey Form—Portland region. [*Source*: *Task 4—Gate and Establishment Survey Plan Memorandum (8).*]

FOCUS AND STAKEHOLDER GROUP SURVEYS—FREIGHT STUDIES

A number of organizations conducting freight transportation surveys or freight studies collect qualitative information alone, or in addition to, quantitative data. Qualitative surveys collect information about the "what," the "why" or "why not," and the "how do we make it better," and they can be targeted to specific topics. The surveys may solicit factual information as well as attitudes. They are conducted by telephone, on paper, in person, or via the Internet. They may be conducted as part of focus or stakeholder group surveys. Although the results may be used in decision-making, they differ from "quantitative" surveys (e.g., origin-destination or commodity flow surveys) in that they are not necessarily statistically representative, commonly by design (as evidenced by the practice cited here); nor are they intended for modeling or forecasting.

Several recent freight studies have collected a wide variety of qualitative information about freight transportation. Common topics include:

- Type of business, primary products (for shippers), size, location, modes of transportation used.
- Establishment operations questions (i.e., who makes decisions about routing, mode, type of scheduling). A number of surveys collected information about operations; the 2008 *Washington Transportation Plan Update Freight Movement* studied the nature and importance of on-time delivery. The survey asked shippers and carriers to identify the amount of time late delivery is still considered to be "on time" (*14*). Figure 5 shows the results of this question.
- Ranking or identification of issues and prioritization of solutions. The 2008 *Austin Area Freight Transportation Study* asked respondents to rank freight transportation challenges according to severity on a scale of 1 to 5 (*15*).
- Bottlenecks and points of congestion in the freight network.
- Challenges and opportunities concerning freight transportation.
- Measure of the level of support for different types of proposed initiatives. The 2008 Los Angeles SCAG (Southern California Association of Governments) Multi-County Goods Movement Action Plan services study asked respondents to indicate their level of support for a long list of previously identified initiatives. Rankings ranged from 1 (no support) to 5 (highly supportive). The survey also provided a list of highway locations and asked respondents to identify which locations they think would benefit from a truck lane or an additional mixed flow lane. Respondents were then asked to rank their choices (*16*). Figure 6 is an excerpt from the question concerning potential initiatives. Figure 7 is an excerpt showing the question concerning truck lanes.
- Impacts of congestion and delays on business costs and profit
- Freight infrastructure investment priorities

Exhibit 57 : Washington Industry Definitions of 'ON-TIME'

Amount of Time Late a Delivery is Considered to be "On Time"	% Under 30 min.	% 30-59 min.	% 1-1.9 hrs.	% 2-2.9 hrs.	% 3-7.9 hrs.	% 8-11.9 hrs.	% 12-23.9 hrs.	% 24 hrs.	% Over 24 hrs.	Median hrs.
Eastern Washington										
Spokane Manufacturing	0.0	0.0	28.6	0.0	0.0	9.5	0.0	52.4	9.5	24.0
SE WA Agriculture	12.5	0.0	41.7	0.0	0.0	0.0	0.0	41.7	4.2	1.5
N. Central Agriculture	4.0	0.0	12.0	4.0	4.0	0.0	0.0	68.0	8.0	24.0
Spokane Trucking	18.2	0.0	54.5	9.1	9.1	0.0	0.0	9.1	0.0	1.5
Vancouver: SW Washington										
Vancouver: SW WA Mnf	0.0	0.0	36.0	0.0	0.0	8.0	4.0	44.0	8.0	18.0
Vancouver: SW WA Trk	5.6	0.0	27.8	0.0	0.0	0.0	0.0	38.9	27.8	19.4
NW Washington/Puget Sound										
Eastside/Central PS Mnf	0.0	0.0	25.0	0.0	8.3	0.0	0.0	54.2	12.5	24.0
South King Manufact	9.7	0.0	29.0	3.2	3.2	3.2	3.2	45.2	3.2	19.8
Eastside/Central PS Trk	3.4	3.4	48.3	0.0	0.0	0.0	0.0	37.9	6.9	1.5
NW WA Manufacturing	8.3	8.3	12.5	0.0	4.2	8.3	0.0	50.0	8.3	24.0

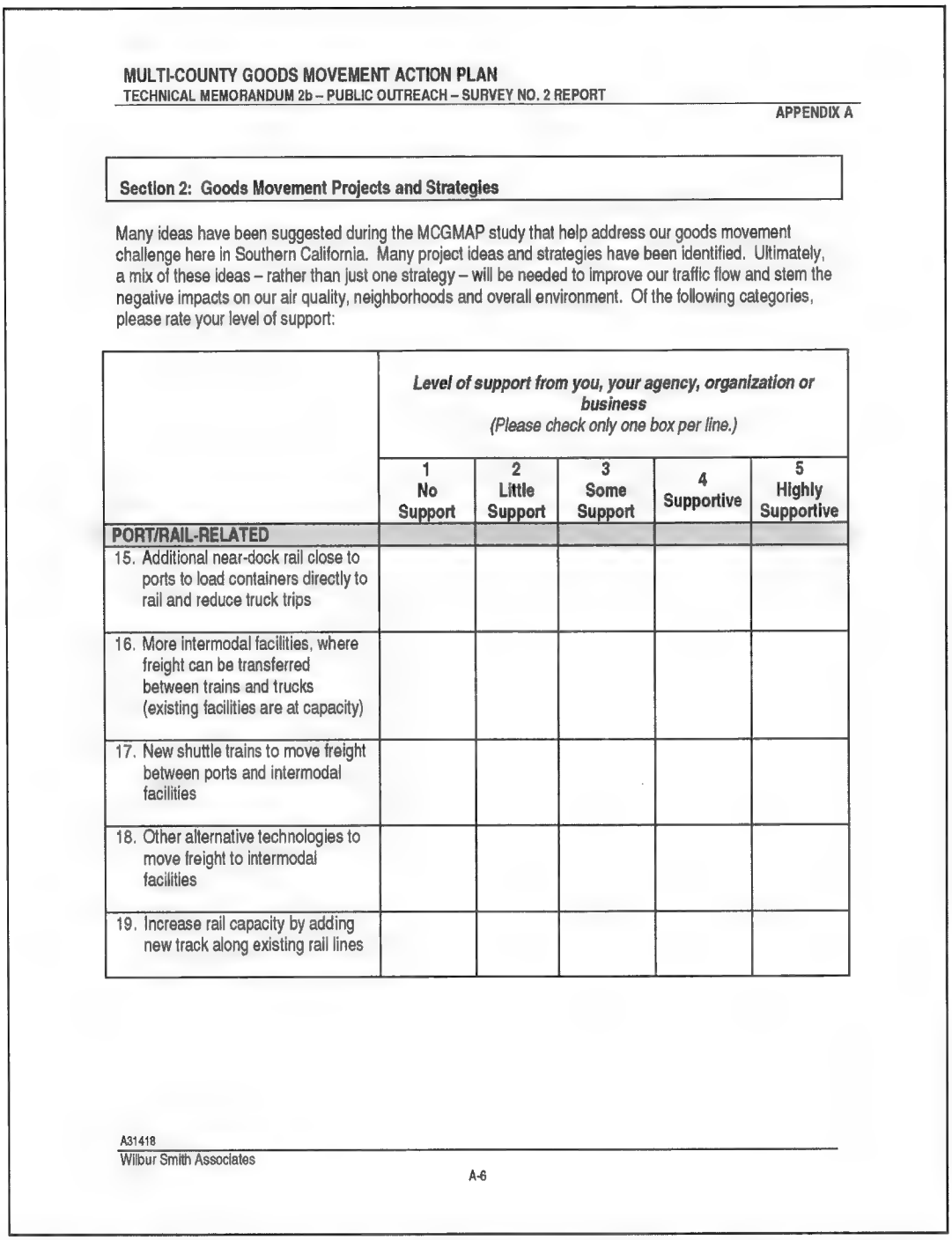
Exhibit 58: Percent of Time Industry Incurs Additional Expense Due to Freight System

Percent of Time Spent Incurring Additional Expenses to Recover from Shipping Problems	% 0	% 1-4	% 5-9	% 10-19	% 20-49	% 50-100	% Mean
Eastern Washington							
Spokane Manufacturing	11.1	50.0	16.7	11.1	5.6	5.6	6.89
SE WA Agriculture	50.0	14.3	0.0	7.1	28.6	0.0	11.08
N. Central Agriculture	38.9	0.0	5.6	22.2	16.7	16.7	22.50
Spokane Trucking	0.0	10.0	40.0	20.0	20.0	10.0	19.80
Vancouver: SW Washington							
Vancouver: SW WA Manufacturing	20.0	20.0	5.0	20.0	20.0	15.0	14.78
Vancouver: SW WA Trucking	8.3	41.7	8.3	33.3	8.3	0.0	8.08
NW Washington/Puget Sound							
Eastside/Central Puget Sound Manuf.	24.0	32.0	16.0	8.0	12.0	8.0	10.33
South King Manufacturing	0.0	8.7	60.9	8.7	21.7	0.0	8.45
Eastside/Central Puget Sound Trk	17.4	43.5	4.3	21.7	4.3	8.7	11.09
NW Washington Manufacturing	7.7	15.4	7.7	23.1	38.5	7.7	16.30

FIGURE 5 "On-Time" delivery—Questionnaire tabulations—Washington State. [*Source*: *Washington Transportation Plan Update Freight Movement (14).*]

The Arizona Multimodal Freight Analysis Study survey asks a number of questions about the importance of different factors to a shipper's transportation decisions. The survey includes open-ended questions asking respondents to note what efforts would improve their experiences, or encourage them to shift to another mode of transportation. These types of surveys attempt to gather anecdotal information about the strengths and weaknesses of the freight transportation network and assess what investments would be most appreciated by stakeholders (*17*). The Kansas DOT Carrier interview guide included a question asking why some routes are chosen over others and whether routes are preplanned or chosen by the operator (*18*). Figure 8 shows sample open-ended questions from the *Arizona Multimodal Freight Analysis Study* survey.

There are three overall strategies for qualitative data gathering:



MULTI-COUNTY GOODS MOVEMENT ACTION PLAN
TECHNICAL MEMORANDUM 2b – PUBLIC OUTREACH – SURVEY NO. 2 REPORT
APPENDIX A

Section 2: Goods Movement Projects and Strategies

Many ideas have been suggested during the MCGMAP study that help address our goods movement challenge here in Southern California. Many project ideas and strategies have been identified. Ultimately, a mix of these ideas – rather than just one strategy – will be needed to improve our traffic flow and stem the negative impacts on our air quality, neighborhoods and overall environment. Of the following categories, please rate your level of support:

	Level of support from you, your agency, organization or business *(Please check only one box per line.)*				
	1 No Support	**2 Little Support**	**3 Some Support**	**4 Supportive**	**5 Highly Supportive**
PORT/RAIL-RELATED					
15. Additional near-dock rail close to ports to load containers directly to rail and reduce truck trips					
16. More intermodal facilities, where freight can be transferred between trains and trucks (existing facilities are at capacity)					
17. New shuttle trains to move freight between ports and intermodal facilities					
18. Other alternative technologies to move freight to intermodal facilities					
19. Increase rail capacity by adding new track along existing rail lines					

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FIGURE 6 Survey excerpt (Support for Potential Initiatives)—Southern California. [*Source*: *Multi-County Goods Movement Action Plan: Technical Memorandum 2b: Public Outreach—Survey No. 2 Report (16).*]

- Primarily qualitative surveys with little or no quantitative data gathered,
- Primarily quantitative surveys with a small number of qualitative questions, and
- Stakeholder interviews.

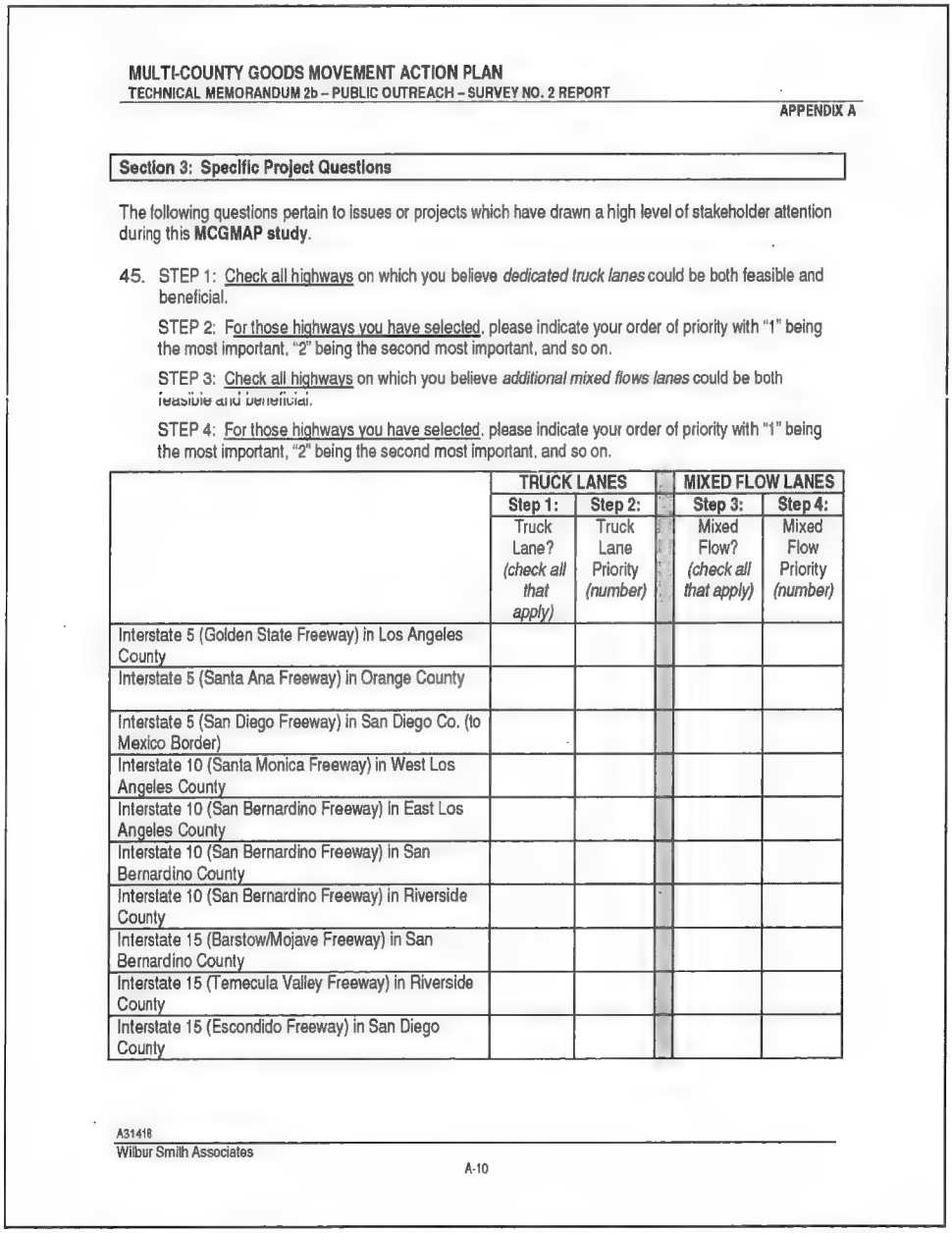
Many of the surveys reviewed were primarily qualitative; in these surveys, origin-destination, routing, and quantity of commodity are not addressed, although some surveys ask a mix of question types. In addition to primarily qualitative surveys, some surveys were primarily quantitative with some qualitative questions included. Many surveys included an open-ended "comments" space where any feedback could be provided.

More specifically than "surveys," many agencies conducted specific stakeholder consultation interviews. These interviews tend to be more qualitative in nature and ask a

smaller number of respondents for their input on freight planning subjects, as discussed earlier. The 2008 *Virginia Statewide Multimodal Freight Study* included two types of interviews: scripted interviews with set questions and unscripted "free-ranging" interviews conducted by personnel with experience in freight planning. Scripted interviews allowed for easy compilation of results, whereas unscripted interviews allowed for more detailed exploration of information that would not have been uncovered by the standard script (*19*). For the 2008 Atlanta Regional Freight Mobility Plan, a mix of surveys were used, with origin-destination surveys separate from stakeholder surveys and targeted interviews. The stakeholder survey was entirely quantitative, whereas targeted interviews were qualitative (*20*).

Some agencies reported poor response rates. For the *Arizona Multimodal Freight Analysis Study*, the consultant team made more than 200 phone calls to shipper/receiver organizations but realized only 12 completed interviews (*17*).

In addition to surveys of shippers, receivers, carriers, and other bodies directly involved in freight transportation, two other types of qualitative surveys are conducted: surveys of public agencies and public consultation surveys. For the Kansas DOT's Statewide Freight Study, three surveys were administered: one for shipper/receivers, one for carriers, and one for public agencies. Questions were tailored to each group, but all asked about modes of choice and the performance of the freight transportation network (*18*).



MULTI-COUNTY GOODS MOVEMENT ACTION PLAN
TECHNICAL MEMORANDUM 2b – PUBLIC OUTREACH – SURVEY NO. 2 REPORT
APPENDIX A

Section 3: Specific Project Questions

The following questions pertain to issues or projects which have drawn a high level of stakeholder attention during this **MCGMAP study**.

45. STEP 1: Check all highways on which you believe *dedicated truck lanes* could be both feasible and beneficial.

STEP 2: For those highways you have selected, please indicate your order of priority with "1" being the most important, "2" being the second most important, and so on.

STEP 3: Check all highways on which you believe *additional mixed flows lanes* could be both feasible and beneficial.

STEP 4: For those highways you have selected, please indicate your order of priority with "1" being the most important, "2" being the second most important, and so on.

	TRUCK LANES		MIXED FLOW LANES	
	Step 1: Truck Lane? *(check all that apply)*	Step 2: Truck Lane Priority *(number)*	Step 3: Mixed Flow? *(check all that apply)*	Step 4: Mixed Flow Priority *(number)*
Interstate 5 (Golden State Freeway) in Los Angeles County				
Interstate 5 (Santa Ana Freeway) in Orange County				
Interstate 5 (San Diego Freeway) in San Diego Co. (to Mexico Border)				
Interstate 10 (Santa Monica Freeway) in West Los Angeles County				
Interstate 10 (San Bernardino Freeway) in East Los Angeles County				
Interstate 10 (San Bernardino Freeway) in San Bernardino County				
Interstate 10 (San Bernardino Freeway) in Riverside County				
Interstate 15 (Barstow/Mojave Freeway) in San Bernardino County				
Interstate 15 (Temecula Valley Freeway) in Riverside County				
Interstate 15 (Escondido Freeway) in San Diego County				

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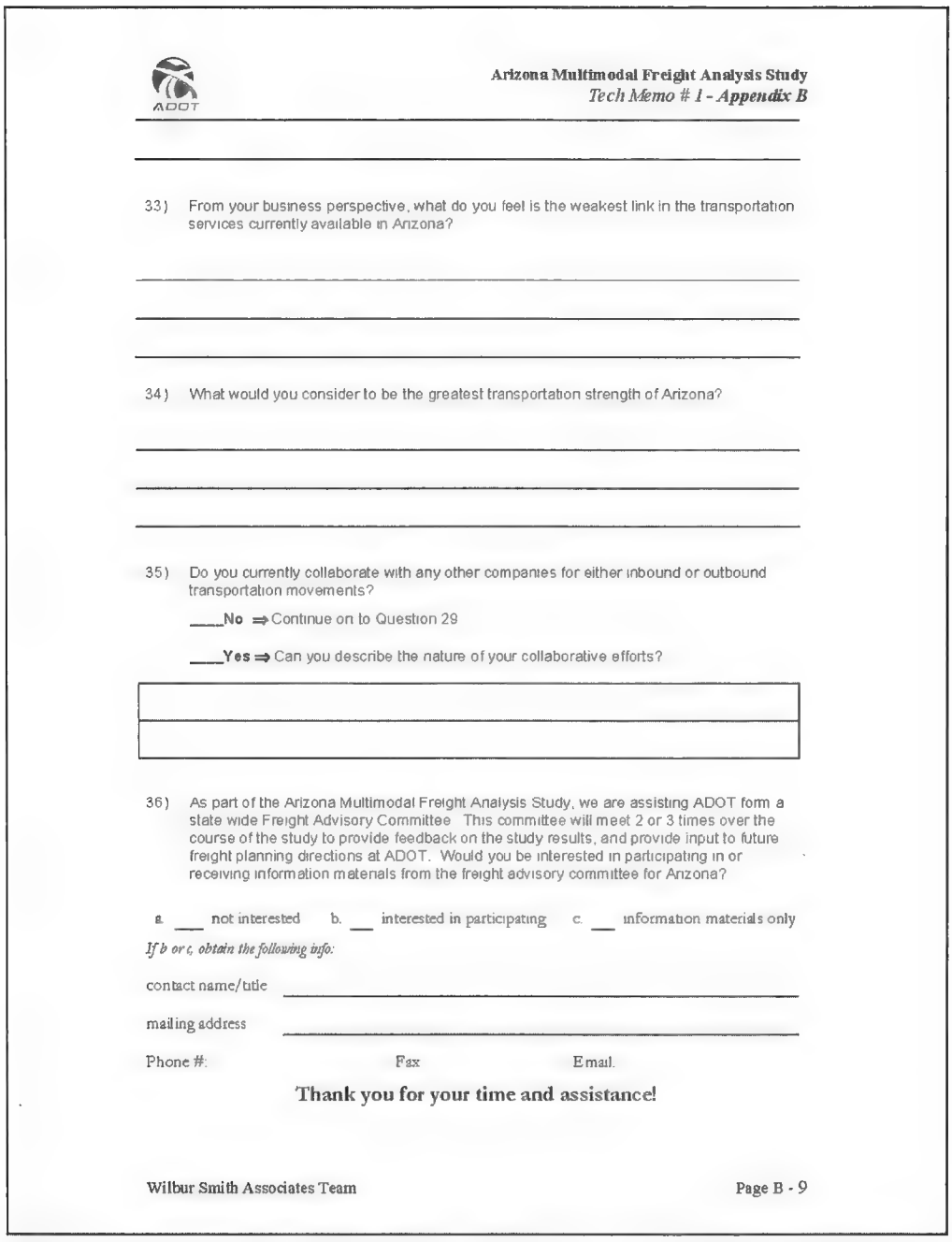
A-10

FIGURE 7 Survey excerpt (Potential Truck Lane Locations)—Southern California. [*Source*: *Multi-County Goods Movement Action Plan: Technical Memorandum 2b: Public Outreach—Survey No. 2 Report (16).*]



ADOT

Arizona Multimodal Freight Analysis Study
Tech Memo # 1 - Appendix B

33) From your business perspective, what do you feel is the weakest link in the transportation services currently available in Arizona?

34) What would you consider to be the greatest transportation strength of Arizona?

35) Do you currently collaborate with any other companies for either inbound or outbound transportation movements?

____**No** ⇒ Continue on to Question 29

____**Yes** ⇒ Can you describe the nature of your collaborative efforts?

36) As part of the Arizona Multimodal Freight Analysis Study, we are assisting ADOT form a state wide Freight Advisory Committee. This committee will meet 2 or 3 times over the course of the study to provide feedback on the study results, and provide input to future freight planning directions at ADOT. Would you be interested in participating in or receiving information materials from the freight advisory committee for Arizona?

a. ___ not interested b. ___ interested in participating c. ___ information materials only

If b or c, obtain the following info:

contact name/title _____

mailing address _____

Phone #: Fax Email

Thank you for your time and assistance!

Wilbur Smith Associates Team **Page B - 9**

FIGURE 8 Sample open-ended questions—Arizona. [*Source*: *Arizona Multimodal Freight Analysis Study, Technical Memorandum #1, Analysis of Arizona's Freight Dependent Industries (17).*]

Finally, several examples of surveys of "establishments" were found in the United States: however, it is important to differentiate the majority, which constituted attitudinal surveys on goods movement issues, from those that collected quantitative information using a statistically representative sample. The Establishment Surveys section presents case studies of the latter. An example of the former is a 2006 online and mail survey of public and private establishments in Southern California (*21*). The survey solicited information regarding goods movement issues in the region, but it cannot be considered as either quantitative or as representing a statistically valid sample (nor was any intent to this effect claimed). A 2007 establishment survey, designed to be administered by the Metropolitan Washington Council of Governments, solicited the type of quantitative information on a firm's activities that can be gathered in an establishment survey (although, notably, vehicle surveys were not included) as well as "anecdotal" input regarding issues. The survey was intended to target "a sample subset" of area businesses that ship or receive a substantial amount of goods to, from, or within the region; trucking companies (including mail/package delivery firms); rail companies; air freight services; and shipping industry associations or representatives. However, it also was understood that this survey would not represent a "scientifically formulated survey" (*22*).

FOCUS AND STAKEHOLDER GROUP SURVEYS—SPECIFIC TOPICS

Another type of focus and stakeholder group surveys is not associated with statewide or regional freight studies but, rather, with specific topics. For example, a 2007 paper reported on an attitudinal survey that was conducted of 71 Georgia-based trucking firms regarding their opinions on a proposed truck-only toll lane scheme alongside Interstate highways in the Atlanta region, proposed to relieve congestion. The respondents included both small carriers (10 or fewer power units) and large carriers (more than 200 power units). The survey solicited information about the firm's activities—notably, the geographic extent of its services, its frequency of use of the region's highways, the most frequently used highways, the time of day of operations, locations of the most severe congestion, use of alternate routes to avoid congestion, importance of delivery time, use of truck-only lanes, and the willingness to pay (*23*).

A 2005 study of the acceptability by truck drivers of in-vehicle technological feedback systems to improve safety illustrates the use of focus groups and stakeholder surveys. (For example, an electronic sensor might monitor driver alertness.) Focus groups were used to collect qualitative information from 66 long-haul drivers in New England regarding attitudes toward technology and feedback. The results were used to develop a questionnaire, which then was administered to 198 long-haul truck drivers to provide quantitative information (*24*).

More details on the efficacy of the focus group and stakeholder surveys are provided in a 2009 paper reported on the development of level of service (LOS) factors that are specific to the trucking community. This is in contrast to the commonly used traffic engineering techniques, such as those of the *Highway Capacity Manual*, which develop a single LOS for all types of traffic combined. The development of specific LOS factors for the trucking community reflected the unique size and operating characteristics of large trucks: in turn, these factors could be used to assess how well the statewide road system meets the needs of freight transportation.

The study sought input from two stakeholder groups: truck drivers ("the most important group concerning truck LOS, in that they are the ones who actually drive the trucks on the road") and truck company managers (whose input was sought "so they could be compared with those of the truck drivers"). Perceptions on the "truck trip quality" were gathered from each group, first qualitatively through focus groups and then through the administration of stakeholder surveys to corroborate the perceptions. Two sets of forms were prepared in order to account for the differing background characteristics; however, the analytical questions were identical.

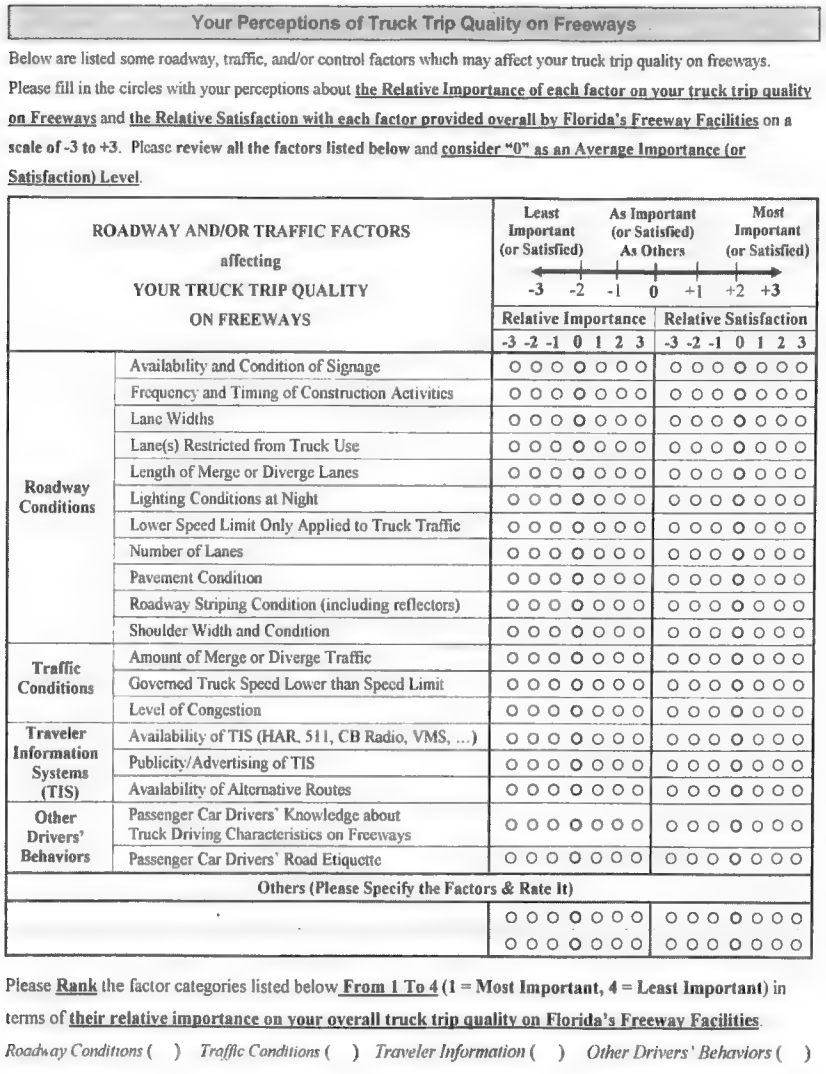
Figure 9 provides a sample question, which asks for driver perceptions regarding the quality of travel on freeway sections, according to several factors. Questions on both the relative satisfaction of each factor and the importance of the factor are asked. A seven-point relative interval rating scale is used, where –3 is "least important/least satisfied," 0 is "as important or as satisfied as others," and +3 is "most important/most satisfied." The use of a seven-point scale "balances the level of detail in measurement of the respondents' perceptions and the respondent burden and error." The use of a "typical" interval-rating, ordinal or ranking scale was not considered to be appropriate. This was because a typical interval-rating scale question allows the respondent to give an equal importance to all factors, thus making the distinction among factors difficult. An ordinal scale or ranking question does not allow mathematical interpretation of the survey responses, thereby restricting the applicability of various statistical analyses.

The study's authors noted the difficulty in gaining driver participation in the surveys. They first conducted the survey at the Florida Truck Driving Championship, where paper forms were distributed to drivers as they registered for the event. However, despite ongoing publicity during the event, only 11 of 148 surveys were returned. As a result, a second survey was conducted; this time, through the distribution by Florida DOT staff to truck drivers at four agricultural inspection stations. Four thousand mail-back questionnaires were distributed, of which 311 were returned (7.8% response rate). Another 300 mail-back truck manager surveys were sent to 60 Florida-based carriers (five surveys each): with follow-up telephone calls, 27 surveys were returned (9% response rate) (*25*).

Finally, two 2008 studies in Washington are of interest. One study used online surveys of truck drivers who drive in that state and of trucking companies that operate in the state to gather information regarding the adequacy and availability of truck parking and services in the state, in light of federal regulations that require minimum rest periods and of the need for short-term parking while drivers are waiting to make a delivery or pick up a load (*26*). The survey was publicized by e-mail among trucking associations and via the state DOT's freight industry stakeholder e-mail list, in industry publications, and on trucking programs on satellite radio. No information is provided about the total population, and a sample was not drawn statistically. However, 473 drivers and 99 companies responded.

The surveys generally were similar, and asked:

- Characteristics of the carrier/company type, including normal areas of operation and types of vehicles used in the state, and frequency of trips
- Where trucks currently park, with a specific breakdown by rest and service area location



Your Perceptions of Truck Trip Quality on Freeways

Below are listed some roadway, traffic, and/or control factors which may affect your truck trip quality on freeways. Please fill in the circles with your perceptions about the Relative Importance of each factor on your truck trip quality on Freeways and the Relative Satisfaction with each factor provided overall by Florida's Freeway Facilities on a scale of -3 to +3. Please review all the factors listed below and consider "0" as an Average Importance (or Satisfaction) Level.

ROADWAY AND/OR TRAFFIC FACTORS affecting YOUR TRUCK TRIP QUALITY ON FREEWAYS		Least Important (or Satisfied) -3 -2 -1	As Important (or Satisfied) As Others 0	Most Important (or Satisfied) +1 +2 +3
		Relative Importance		Relative Satisfaction
		-3 -2 -1 0 1 2 3		-3 -2 -1 0 1 2 3
Roadway Conditions	Availability and Condition of Signage	O O O O O O O		O O O O O O O
	Frequency and Timing of Construction Activities	O O O O O O O		O O O O O O O
	Lane Widths	O O O O O O O		O O O O O O O
	Lane(s) Restricted from Truck Use	O O O O O O O		O O O O O O O
	Length of Merge or Diverge Lanes	O O O O O O O		O O O O O O O
	Lighting Conditions at Night	O O O O O O O		O O O O O O O
	Lower Speed Limit Only Applied to Truck Traffic	O O O O O O O		O O O O O O O
	Number of Lanes	O O O O O O O		O O O O O O O
	Pavement Condition	O O O O O O O		O O O O O O O
	Roadway Striping Condition (including reflectors)	O O O O O O O		O O O O O O O
	Shoulder Width and Condition	O O O O O O O		O O O O O O O
Traffic Conditions	Amount of Merge or Diverge Traffic	O O O O O O O		O O O O O O O
	Governed Truck Speed Lower than Speed Limit	O O O O O O O		O O O O O O O
	Level of Congestion	O O O O O O O		O O O O O O O
Traveler Information Systems (TIS)	Availability of TIS (HAR, 511, CB Radio, VMS, ...)	O O O O O O O		O O O O O O O
	Publicity/Advertising of TIS	O O O O O O O		O O O O O O O
	Availability of Alternative Routes	O O O O O O O		O O O O O O O
Other Drivers' Behaviors	Passenger Car Drivers' Knowledge about Truck Driving Characteristics on Freeways	O O O O O O O		O O O O O O O
	Passenger Car Drivers' Road Etiquette	O O O O O O O		O O O O O O O
Others (Please Specify the Factors & Rate It)				
		O O O O O O O		O O O O O O O
		O O O O O O O		O O O O O O O

Please Rank the factor categories listed below From 1 To 4 (1 = Most Important, 4 = Least Important) in terms of their relative importance on your overall truck trip quality on Florida's Freeway Facilities.

Roadway Conditions ( ) *Traffic Conditions* ( ) *Traveler Information* ( ) *Other Drivers' Behaviors* ( )

Figure 1. A Truck Driver Survey Example on Relative Importance/Satisfaction of Each Factor

FIGURE 9 Perception of truck trip quality on freeways—Florida. [*Source*: *B. Ko et al. (2009) (25).*]

- Parking requirements (size, width, height)
- When and for how long they park
- What services they use when they park
- What improvements should be made at truck parking areas
- Where it makes most sense to increase available truck parking
- Where additional truck parking areas should be developed.

The second study solicited information on the economic impacts to Washington State shippers and carriers of weather-related closures to I-5 and I-90 (key north-south and east-west corridors, respectively) during the winter of 2007–2008. The survey contacted 2,758 establishments sampled from trucking industries and from businesses active in seven "freight dependent" industrial sectors that also owned commercial trucks. (An initial sample frame for the latter included businesses that did not necessarily own commercial trucks; however, this resulted in a high number of ineligible [i.e., inapplicable] cases, and so the scope was narrowed in order to generate a usable response.) The survey was conducted as a telephone interview; however, respondents were offered the option of participating via an Internet survey. Of the 1,750 completed responses, 1,513 participated through a short telephone interview and 237 respondents completed a web survey for an overall response rate of 69.6%. Up to 10 contacts were made with each sampled organization, to encourage participation. The telephone interviews ranged between 5 and 50 minutes in length, with an average duration of 20.5 minutes. A computer-assisted telephone interview (CATI) was used to allow data validation to be conducted during the interview (e.g., by prompting the interviewer to ask about missing information as responses were processed) (*27*).

The survey solicited information about the December 2007 I-5 closure at Centralia, Washington, and the January 2008 I-90 closure at Snoqualmie Pass, including:

- Extent, if any, of "negative" economic impact to the respondent's business
- Types of response to the closure (cancel, postpone, or reroute truck shipments; other)
- Number of truck shipments impacted by the closure
- Characteristics of rerouted shipments:
  - Detour route used
  - Number of trucks using each detour route
  - Increases in journey time
  - Additional direct costs
  - Why this route was selected (available, less severe weather, nearest alternative, safest, other)
  - Source of information about detour routes (highway posted radio channel, company dispatch or contact, truck weigh station, Washington DOT freight electronic mailing list, media, State Patrol, other)
- Total additional costs incurred by the respondent during the closure (ranges), broken down by type of cost [overtime hours and drivers' expenses, additional fuel, acquisition of additional equipment, higher rates for expedited or guaranteed services, additional inventory and storage, costs of damaged goods (e.g., perishables), other]
- Duration of incurrence of additional costs
- Total additional costs after the closure was reopened, if any
- Whether any of additional costs were recovered, broken down by type of cost
- Whether the respondent planned to make any capital or operating investments that year to prevent future business disruptions owing to potential closures at the same location; and the estimated value of these investments
- Value of lost sales because of the closure, and associated characteristics (how estimate was derived, percentage of total annual revenues, duration of impact)
- Total annual sales (revenue) for the respondent's business in Washington.

It should be noted that the study reports the survey results but does not analyze or interpret them. The report includes the CATI and web surveys.

COMMERCIAL TRIP DIARY SURVEYS

Employee Business Trip Log—Ohio

The *2003–2004 Ohio Statewide General Establishment Survey* included a commercial trip diary survey. The survey was administered to employees of sampled establishments (see also Establishment Survey—Ohio for a discussion of these establishment surveys).

"Form B" covered trips related to business. The form solicited information about the employee's trip or "tour," including the vehicle type, origin and destination location of each leg of the day's activities, arrival and departure times, activity conducted at each stop, and value of service provided. The list of activities accounted for both commercial services and the movement of goods. The list comprised business meeting, sales/marketing visit, provision of services, break/meal, vehicle service/refueling, pick up of material or equipment, drop off of material or equipment, return to work, return to home, and other. Respondents were asked to check all that applied (*28*). Figure 10 provides a sample of this form.

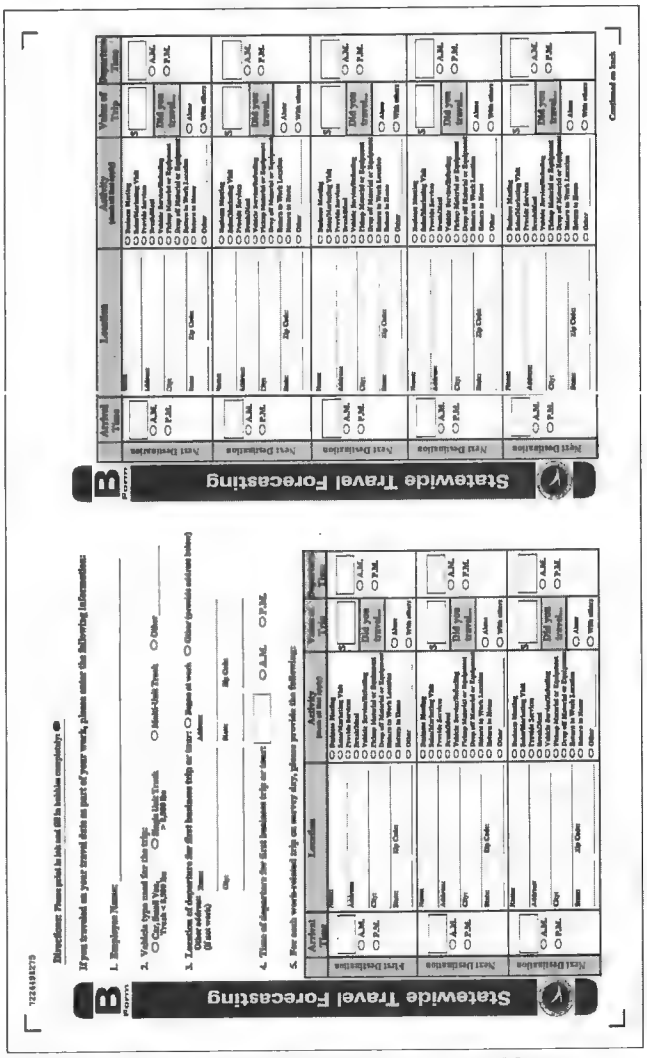


FIGURE 10 Employee business trip log—Ohio. [*Source: 2003–2004 Ohio Statewide General Establishment Survey, Technical Memorandum (28).*]

Commercial Vehicle Trip Diary—United Kingdom

The United Kingdom's Continuing Survey of Roads Goods Transport (CSRGT) is a long-standing survey of U.K.-registered heavy goods vehicles that operate on the country's

roads. The ongoing survey has been conducted for several decades in the United Kingdom and Northern Ireland. Samples are drawn from driver and vehicle registries. The sampled driver or operator of each vehicle completes a log for each trip that is made over the course of one week. Participation, once selected for the sample, is mandatory.

The CSRGT is one of several programs that collect information on goods movement. One result is that inconsistencies have been reported in some tabulations; notably, in vehicle activity (vehicle-kilometers traveled), and there was evidence of under-reporting from the CSRGT because of apparent record-keeping inaccuracies (paper forms are used by the drivers), the need for drivers to distinguish domestic legs of a multicountry trip, apparent difficulty in the ability of automatic traffic recorders (which are used to expand the data) to distinguish between some large and small vehicles (the CSRGT includes only heavy vehicles over 3.5 tonnes gross vehicle weight), the exclusion of certain types of vehicles from the CSRGT sample (including cranes, fire engines, and large army vehicles), and a lack of precision in tachograph data, which some respondents were using to record their mileage (*29*). Figure 11 provides a sample of the form.

Goods Vehicle Trip Diary—Ireland

The *National Survey of Transport of Goods by Road* is conducted by the Central Statistics Office of the Republic of Ireland. As with its U.K. counterpart, participation is mandatory. Approximately 30,000 goods vehicles are sampled per year. A random sample is drawn from official registries of all goods vehicles having an unladen weight of 2 tonnes or more. The sample is spread evenly throughout the year. Samples are selected weekly, and a questionnaire is mailed to the registered owner of the vehicle. Three strata are used for sampling, according to unladen weight (sampling rates are shown in parentheses): 2–5 tonnes (15% sample), 5–10 tonnes (50%), and 10 tonnes and over (90%). The strata sampling rates remain constant for each weekly draw. Because the rates have remained constant over several years, and because the fleet size has increased over time, the weekly sample size increases gradually (*31*).

Survey results are tabulated each quarter. The activities of each sampled vehicle are recorded for 1 week. If the vehicle has been sold or scrapped, then no further details are recorded on the form. The survey asks for information about the owner's business; the characteristics of the vehicle, including the number and positioning of axles; and the type of work "normally" carried out by the vehicle. A question on "respondent burden" asks how many minutes it took for the respondent to complete the form. Finally, a 7-day trip log is to be completed: for each trip on each day, the origin and destination, type of goods carried, weight of goods carried at the beginning of the journey, distance traveled empty and loaded (miles), information on "split" delivery/pick-up journeys (i.e., tours in which both pick-ups and deliveries are made), and the frequency of similar journeys, with similar loads, made during the same day. Figures 12–14 present the three pages of the survey form.

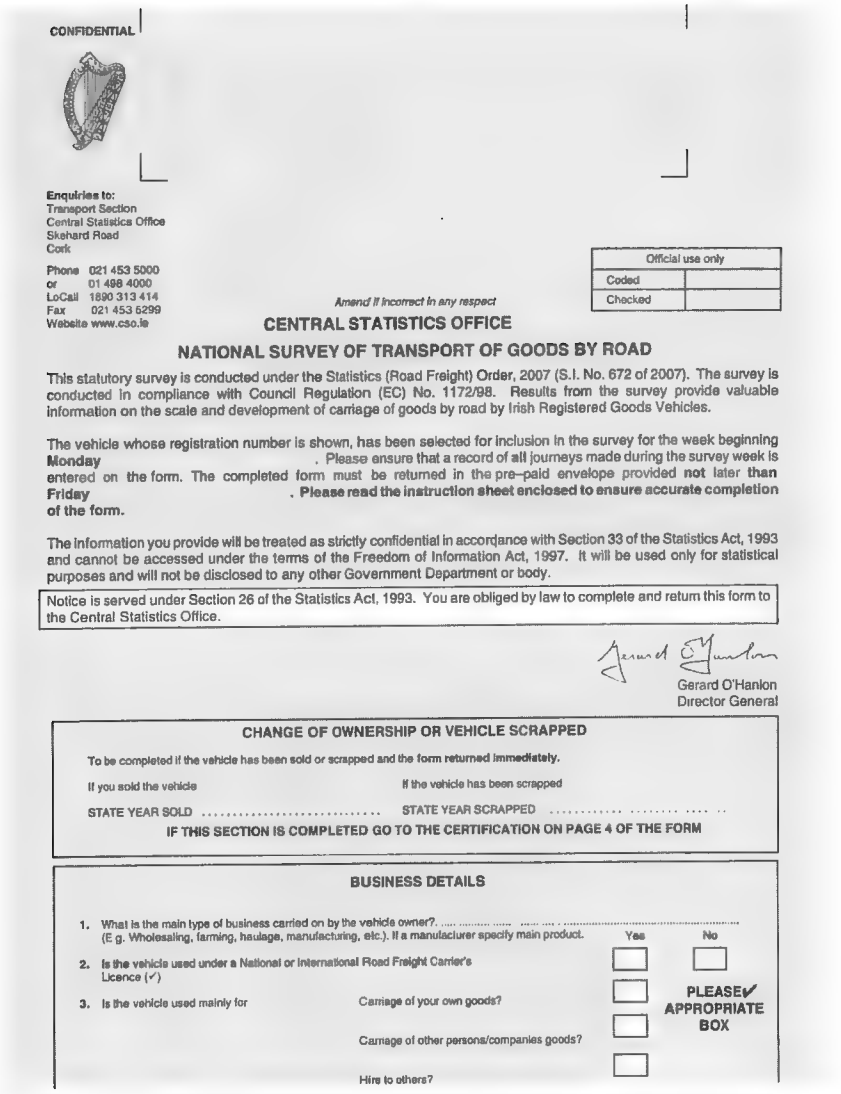
Multiday Urban Vehicle Trip Diary—United Kingdom

An example of a multiday vehicle trip diary is provided by the 2001 Birmingham, Basingstoke, and Norwich, U.K. survey of freight distributors. That survey included a 3-day vehicle trip diary survey, which was administered to drivers of the vehicles of the seven surveyed freight distributors. The survey gathered four types of information (*35*):

- Vehicle activity: date of the delivery round (i.e., tour), depot departure and return times, odometer readings at the start and end of the trip, vehicle age and type, and the commodity type on board the vehicle when it left the depot.
- Stop characteristics (for each stop): arrival and departure times, distance traveled between stops, activity type (delivery, pick-up, both, other), name and address of the stop, quantity of goods delivered or picked up, where the vehicle was parked, time taken for each delivery or pick-up, and any problems experienced en route.
- Vehicle characteristics: age, make and type, external size, internal load space (volume), gross vehicle weight, maximum payload, fuel type, and vehicle fuel consumption rate.

Day of week	Journeys: Please give nearest town and county name... Origin	Journeys: Destination	Type of Goods	Distance travelled: Loaded mile/km*	Distance travelled: Empty ~~mile~~/km*	Name of town of furthest stop made from origin	Total weight of goods Delivered	Total weight of goods Collected	Number of Stops for Delivery only	Number of Stops for Collection only	Number of stops where both a Delivery and Collection were made
Wed 6 Aug	*Barnstaple, Devon*	*Barnstaple, Devon*	*Soft drinks & empty*	*606*		*Reading, Berks*	*7986*	*3350*	*2*		*5*

FIGURE 11 Commercial vehicle trip diary (extract)—United Kingdom. [*Source*: *Department for Transport (30).*]



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Amend if incorrect in any respect

CENTRAL STATISTICS OFFICE

NATIONAL SURVEY OF TRANSPORT OF GOODS BY ROAD

This statutory survey is conducted under the Statistics (Road Freight) Order, 2007 (S.I. No. 672 of 2007). The survey is conducted in compliance with Council Regulation (EC) No. 1172/98. Results from the survey provide valuable information on the scale and development of carriage of goods by road by Irish Registered Goods Vehicles.

The vehicle whose registration number is shown, has been selected for inclusion in the survey for the week beginning **Monday** . Please ensure that a record of **all** journeys made during the survey week is entered on the form. The completed form must be returned in the pre–paid envelope provided **not** later **than Friday** . **Please read the instruction sheet enclosed to ensure accurate completion of the form.**

The information you provide will be treated as strictly confidential in accordance with Section 33 of the Statistics Act, 1993 and cannot be accessed under the terms of the Freedom of Information Act, 1997. It will be used only for statistical purposes and will not be disclosed to any other Government Department or body.

Notice is served under Section 26 of the Statistics Act, 1993. You are obliged by law to complete and return this form to the Central Statistics Office.

Gerard O'Hanlon
Director General

CHANGE OF OWNERSHIP OR VEHICLE SCRAPPED

To be completed if the vehicle has been sold or scrapped and the form returned immediately.

If you sold the vehicle — If the vehicle has been scrapped

STATE YEAR SOLD ..... STATE YEAR SCRAPPED .....

IF THIS SECTION IS COMPLETED GO TO THE CERTIFICATION ON PAGE 4 OF THE FORM

BUSINESS DETAILS

		Yes	No
1.	What is the main type of business carried on by the vehicle owner? (E.g. Wholesaling, farming, haulage, manufacturing, etc.). If a manufacturer specify main product.		
2.	Is the vehicle used under a National or International Road Freight Carrier's Licence (✓)	☐	☐
3.	Is the vehicle used mainly for — Carriage of your own goods?	☐	PLEASE✓ APPROPRIATE BOX
	Carriage of other persons/companies goods?	☐	
	Hire to others?	☐	

FIGURE 12 Goods vehicle trip diary, first page—Ireland. [*Source*: *National Survey of Transport of Goods by Roads (32).*]

- Vehicle utilization (over the 3-day period): time idle (empty) at the depot, time vehicle was out on pick-ups or deliveries, and time vehicle was loading/unloading or waiting at the depot, or during a driver rest period.

The large number of stops made by some firms required the assistance of the researchers to accompany the drivers and fill out the survey forms themselves.

ESTABLISHMENT SURVEYS

Portland Freight Data Collection Program—Port of Portland et al.

The Portland freight data program conducted establishment surveys in addition to roadside intercept surveys and vehicle classification counts. The surveys comprised telephone and in-person interviews of the proprietors of key freight-generating facilities in the region, such as warehouses and manufacturing facilities. The surveys gathered data on the facility type and its characteristics: number of employees, hours of operation, facility size, number of loading/unloading bays, whether the facility supported cross-docking capabilities, type (commodity) of products handled, volume of inbound/outbound shipments, distribution of the shipments by time of day and by season, the most common origins and destinations of shipments, average payload weight, empty truck trip fractions, and primary highway access routes to and from the facility (and whether drivers were given routing instructions) (*8*, *36*). The in-person survey is illustrated in Figure 15. Note that the questions solicit information regarding "typical" freight activity. Respondents also were given the opportunity to comment on selected issues.

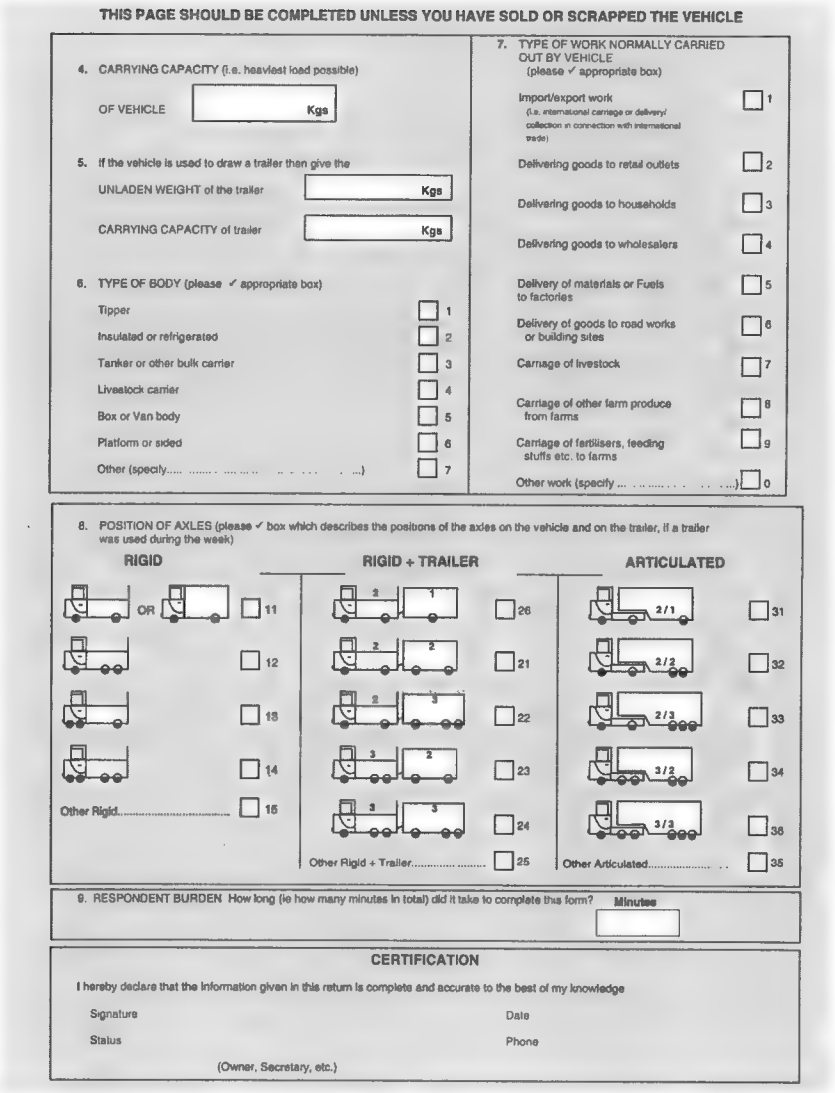

FIGURE 13 Goods vehicle trip diary, second page—Ireland. [*Source*: *National Survey of Transport of Goods by Roads (33).*]

Establishment Survey—Ohio

An establishment survey was conducted as part of the Ohio statewide freight data collection initiative in 2003. This survey covered both goods movement and commercial activity. The survey complemented existing data on freight flows from the TRANSEARCH commercial database and from the U.S. Commodity Flow Survey: to this end, it focused on the types of establishments that are not generally covered in these other sources. (See Commodity Flow Survey section later in this chapter.) Of an initial sample of 9,231 establishments, 593 returned completed survey forms: these represented a response rate of 13% of the sample and a 33% response rate of the 1,781 establishments that actually were recruited for the survey.

The study comprised three separate surveys. Initial recruitment was conducted by telephone, following which an advance letter (which provided more information) was sent by facsimile or by e-mail. A survey date was assigned. The survey forms, including instructions, then were sent by courier. "Form A" verified information regarding the establishment's characteristics that had been collected during the recruitment. The survey also collected information regarding the types of goods shipped and/or services provided off-site, fleet vehicle information, and the composition of the company's labor force (number of employees by industry and occupation classification). "Form B" was an employee business trip log (see Employee Business Trip Log—Ohio earlier in this chapter) (*28*). "Form C" gathered data about outgoing goods shipments on the assigned survey date. The data included type of goods shipped; the quantity shipped; shipment destination; whether a courier, shipper, or common carrier was used (and the firm's identity); type of vehicle used, company vehicle used (if any); activity/trip purpose; and vehicle occupancy. Figure 16 provides a sample of Form C.

RECORD OF WORK DONE BY VEHICLE DURING THE WEEK

NOTES
1. Details of all journeys should be recorded as they are made.
2. Record outward and return journeys on separate lines.
3. Give details of all empty journeys.
4. For type of goods carried (column 4) state main commodity; if no main commodity enter "Sundries". If goods are a dangerous substance please code product as shown on instruction sheet enclosed.
5. Weights should be specified in Kgs. If exact weights are not available, please give estimates or specify other units e.g. Litres, Tonnes, Tons, Cubic Metres, Cubic Feet, etc.
6. If the same journey with a similar load was repeated during the day only one entry is required with the number of such journeys entered in column (12).

DAY OF WEEK	JOURNEYS (Please give nearest town and district)		TYPE OF GOODS CARRIED Give full details	WEIGHT OF GOODS CARRIED AT BEGINNING OF JOURNEY	Distance Travelled		Complete only for split delivery/ collection journeys				NO. of times the same journey with similar load was carried out during the day
	ORIGIN [illegible]	DESTINATION	(See Note 4 above)	(See Note 5)	LOADED	EMPTY	NO. of stops for collection	WEIGHT of all extra loads collected	NO. of stops for delivery	WEIGHT of all goods delivered	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
				KGS	MILES	MILES	NO.	KGS	NO.	KGS	NO.
MONDAY											
TUESDAY											
WEDNESDAY											
THURSDAY											
FRIDAY											
SATURDAY											
SUNDAY											

PLEASE SEE OVER →

FIGURE 14 Goods vehicle trip diary, third page—Ireland. [*Source*: *National Survey of Transport of Goods by Roads (34)*.]

Establishment Survey—Georgia

The *Georgia Statewide Truck Lanes Needs Identification Study* (described in Statewide Truck Lanes Needs Identification Study—Georgia) conducted surveys at seven Savannah-area warehouses. The surveys were used to confirm that these facilities operated primarily as intermediate freight destinations between the Port of Savannah and points further inland, and secondarily as distribution centers for goods that are consumed locally. A mix of public and private warehouses participated in the survey. Together, they accounted for approximately 200,000 trucks moving in and out of their facilities annually. The focus was on the movement of containers (although allowances were made for other trucks); and the data were differentiated according to whether or not the containers were loaded or were empty. The warehouse operators provided information on their hours of operation, the numbers of trucks using the facility, the origins and destinations of the trucks, pick-up and drop-off activity at the warehouse, and seasonal and temporal variations in truck activity (*4*). Figure 17 presents the survey form.

Establishment Surveys—Edmonton/Calgary, Canada

The cities of Edmonton and Calgary, Canada, collaborated on the development of an urban goods model and on the underlying data collection. The two cities, which are 180 miles apart, are the largest cities in the Province of Alberta and have approximately the same population (900,000–950,000 at the time of the surveys described here). The surveys were used in the development of micro-simulation goods and services models for the two cities (*37*).

The surveys were applied in Calgary in 2000–2001 and in Edmonton in 2001–2002. Each combined an establishment survey with an origin-destination survey of truck drivers.

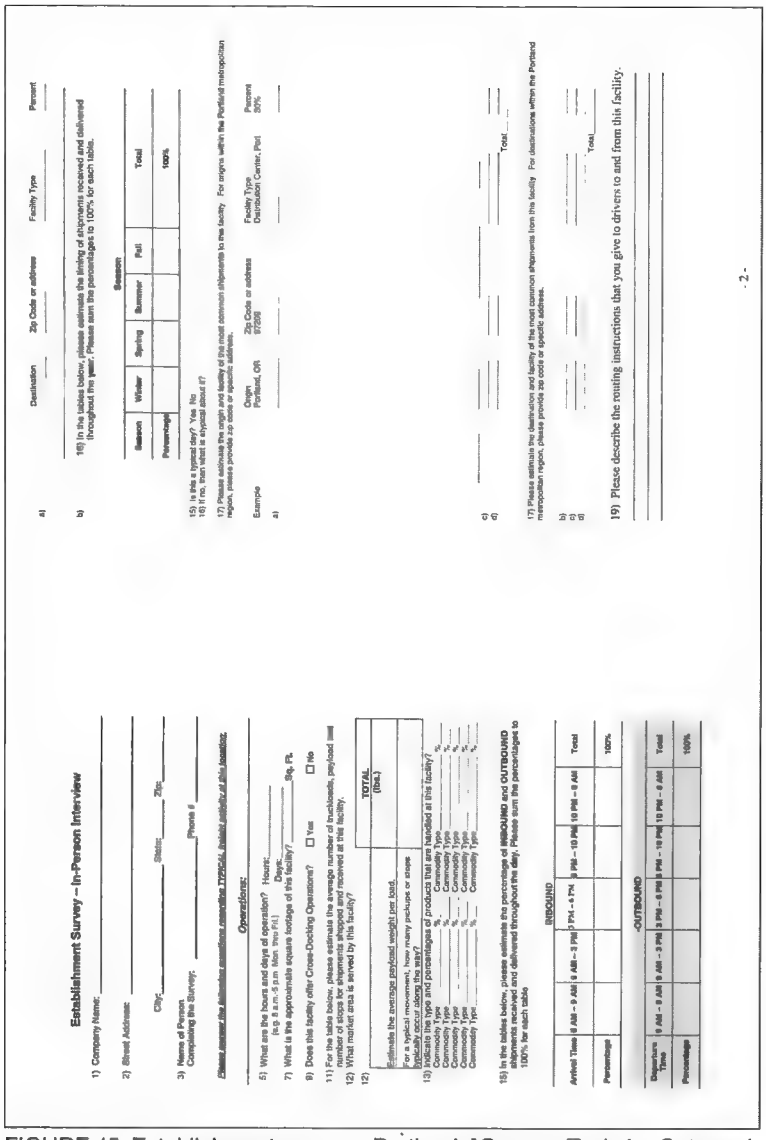

FIGURE 15 Establishment survey—Portland. [*Source*: *Task 4—Gate and Establishment Survey Plan Memorandum (8).*]

The establishment survey captured the activities of a significant sample of all business establishments in the respective region. Drivers of commercial vehicles leaving the establishment then were surveyed regarding the specifics of their goods movement over one weekday. The surveys covered all establishments involved in the shipment of both goods and services, including transportation depots. These urban surveys were complemented by a roadside survey of trucks at an external cordon surrounding each city, to capture interurban goods movement to, from, and through each city.

The surveys attempted to sample all types of businesses. In the Edmonton survey, 27,478 business establishments were contacted to ascertain their eligibility for participating in the establishment survey. Information also was collected regarding the number of employees, location, and industry category of the establishment. Establishments that produced either a product or a service that required transportation were deemed to be eligible. Of the contacted establishments, 13,792 were determined to be eligible, and of these 4,324 agreed to participate in the survey. The survey was expanded according to three independent variables: number of employees, industry category, and geographic location, using the total number of employees within each variable to determine the individual establishment expansion factors. The resultant average expansion factor for all establishments was 2.36 (*38*).

The Calgary experience, which surveyed 3,411 establishments, is instructive insofar as developing the establishment sample is concerned. Difficulties with finding a workable sample database caused delays in the process and required that the sample be verified before the actual survey could begin. Samples ultimately were drawn from the Provincial Treasury ministry's registry of businesses and from the city of Calgary's City Business Tax database. For the city of Cal-

gary, a sample of 49,354 companies, approximately 3.4% of the sample could not be reached because of incorrect telephone numbers (for initial contact and recruitment), the provision only of a facsimile number, or that the company no longer was in business. Another 25.1% did not qualify because they did not ship or used only the postal service or personal couriers, and a further 7.2% were duplicates. Of the remainder, 2.4% declined to participate. In total, 3,791 establishments, or 7.7% of the initial sample, pre-qualified. Of these, 3,150 or 6.4% were recruited, and 3,107 establishments ultimately provided usable data. Another 304 surveys were completed in the surrounding region, for a total of 3,411 surveyed establishments (*39*). As the city of Calgary's experience indicates, the coverage and representation of the establishment survey depends on the availability of appropriate databases; much of the available data were erroneous, duplicates, or otherwise unusable. Moreover, the use of telephone recruitment ensured that sampling quotas were met and that, once recruited, respondents' participation was maximized.

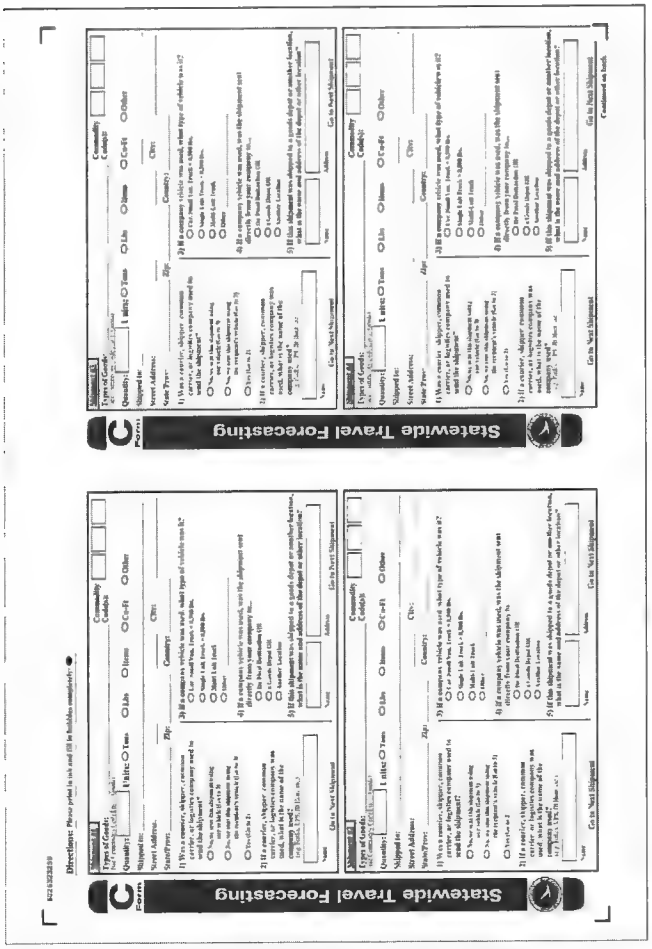

FIGURE 16 Outgoing goods shipment survey—Ohio. [*Source*: *2003–2004 Ohio Statewide General Establishment Survey, Technical Memorandum (28).*]

The challenges of reporting were noted in the Calgary survey. Following the telephone recruitment, packages were delivered to the establishment. Even with the availability of complete or partial support (i.e., the interviewing contractor was available to complete all or part of the survey for the respondent), 92% of the surveys required amendments, including correction of addresses and compilation of the required information from original sources. Respondents had operational differences that impacted the establishment and driver surveys: in particular, the inability to record monetary values of the shipments because product owners did not share this information with them (and the goods were insured by the producing company), value information was kept elsewhere (at a head office), or details could not be broken out. More reporting units of measure than were expected also were received, and had to be reconciled. Consistency for service vehicle reporting was difficult depending, for example, on whether or not the service vehicle was parked at home (i.e., in which case, the first trip of the day may be that from home to the service site, or to work to pick up the service vehicle). Once an establishment had been recruited by telephone, a face-to-face visit followed, in order to obtain management buy-in and personalize the project (*39*).

FIGURE 17 Establishment survey of warehouses—Georgia. [*Source*: *Statewide Truck Lanes Needs Identification Study, Technical Memorandum 1: Data Collection (4).*]

Establishment Survey—San Bernardino Valley

Following on the experience of the Calgary survey, the importance of considering both the sampling base and the recruitment method is illustrated further by an establishment survey that was conducted of local trucking companies and shipper/receiver businesses in the western San Bernardino Valley region (California). Questionnaires were sent to 405 businesses, which were identified through the California Trucking Association and the cities of Ontario and Rancho Cucamonga. Of these, 37 responses, or 9%, were returned: the low response rate was attributed as being "typical" of this type of survey and also because of "other recent surveys" (on unspecified topics) that might have led respondents to view this survey as redundant. It is not clear whether or not direct follow-up contacts were made or if assistance was provided. Moreover, the survey was shorter and less detailed and required less specificity (in terms of shipment type and origin and destination addresses) than, by comparison, the Calgary and Edmonton surveys (*40*).

Online Establishment Survey—Atlanta

The 2008 Atlanta Regional Freight Mobility Plan provides an example of the use of online surveys for conducting an establishment survey. This survey was part of a series of data collection activities, and sampled shippers and carriers that were considered to be "major freight generators" in the Atlanta region. The survey captured information regarding business type; the number of deliveries to warehouses, distribution centers, and businesses; the day of week and (typical) time of day of deliveries; the number of inbound and outbound loads and shipments; and the destination of loads (used to determine routings within the region). A commercial online survey tool was used, which allowed variations of the survey to be distributed to different groups: shippers and receivers, transportation carriers and operators, and the general public. There were 74, 24, and 31 responses respectively. The results were not used for detailed modeling and were combined with other data—including commercial (TRANSEARCH) commodity flow data and roadside interviews—for analysis (*41*). As noted, the sample was limited to "major" generators; and no indication is given that a statistically viable sample was drawn for the "general public." Nonetheless, the study demonstrates the potential of online surveys as a data gathering tool and also as a means of engaging the "public" regarding its freight-generating activities.

COMMODITY FLOW SURVEYS

The Bureau of Transportation Statistics (BTS) and the Bureau of the Census conduct jointly nationwide Commodity Flow Surveys (CFS) at approximately 5-year intervals (1993, 1997, 2002, and most recently in 2007). Freight characteristics were captured in earlier surveys, from 1963 through 1977. However, the CFS represented an important improvement in method, sample size, and scope over the earlier surveys (*42*).

The CFS is a nationwide survey of business establishments in selected industries, specifically in mining, manufacturing, wholesale trade, and selected retail and services establishments (auxiliary establishments). An establishment is defined as "a single physical location where business transactions take place" (*42*). The CFS supplies data on the flow of goods generated by the sampled establishments by mode of transportation in the United States. Data are provided on tons, miles, ton-miles, value, shipment distance, commodity type, and weight. All major modes of freight transportation are captured (*43*).

A sample of establishments is drawn across all 50 states and the District of Columbia. Participation by sampled establishments is mandatory because it is linked to the 5-year Economic Census. The sampling frame is drawn from the Census Bureau's Business Register of approximately 6 million establishments, of which approximately 754,000 establishments (in 2007) were in the industry categories covered by the CFS (44). The sample dropped steadily from 200,000 establishments in 1993 to 100,000 in 1997 and 50,000 in 2002 (*43*). However, it increased back to approximately 100,000 establishments in 2007 (*44*) (i.e., in effect doubling the sample from 2002, as the total number of candidate establishments was approximately the same in both years).

A stratified three-stage sampling process was used in the 2007 CFS (and also previously), as follows (*44*):

- Establishment selection. The sampling frame was first stratified by geography [accounting for the 50 states, the District of Columbia, and 65 metropolitan areas (the last according to population and importance as transportation hubs)]. Within each geographic strata, 48 industry groups were defined (i.e., within the candidate industry types) according to the 2002 North American Industry Classification System). Separate strata of hazardous materials shippers also were created to gain more information on these shipments. The combined geography-by-industry stratification resulted in 2,745 primary strata. Based on these strata, a sample size of 102,369 establishments ensured a minimum of 2 samples and a maximum of 100 samples per stratum.
- Reporting week selection. The sampled establishments were asked to report on 4 weeks—one in each calendar quarter for 2007 (i.e., January 6, 2007, to January 4, 2008). Because different establishments were assigned different times, the sample covered all 52 weeks of the year.
- Shipment selection. If respondents made more than 40 shipments per week, they were asked to conduct a systematic sample to report a minimum of 20 shipments and a maximum of 40 shipments. If respondents made

40 or fewer shipments per week, they reported all shipments (*42*).

Each of the four surveys used a mail-back document, with online assistance provided in 2002 and 2007. Respondents were asked to record the total numbers of their outbound shipments and, for a sample of these shipments, information on value, weight, commodity, domestic destination or port of exit (from the United States), and mode(s) of transportation. Instructions were provided on how to sample the shipments (*43*).

The CFS has the benefit of being the only nationwide source of goods movement data. However, several concerns have been identified (*43*):

- The CFS covers only some industry sectors. This appears to represent less than three-quarters of all goods moved within the United States. Government, farms, construction, oil and gas, and household [which also generate goods] are not sampled. The CFS misses the rapidly growing service sector and most retail establishments (*45*).
- The CFS also does not cover all modes well—in particular, air cargo is not captured well because many of the industries that depend on air are not included in the sampling frame. Also, not all truck activity is captured: only that associated with the industrial sectors covered in the CFS is included (*10*).
- There is a lack of geographic and commodity detail at the state and local levels. This constraint reflects both the stratification of the sample to ensure broad industry and geographic coverage and the need to protect the confidentiality of individual establishments (some of which could be identified easily by their size and location). In addition, the CFS breaks down metropolitan areas along state lines, thereby making it impossible to distinguish intraregional flows from inter-regional flows in multistate urban regions (*9*). The varying CFS sample sizes contribute to the lack of geographic detail (*10*).
- There is no coverage of the external leg outside the United States beyond the ultimate destination. That is, only the mode to the port of exit is identified. Through flows that traverse the United States (e.g., Canada to Mexico) also are not covered. No information is captured regarding imports to the United States, except where they arrive in the country for shipment elsewhere in the United States (*10*).
- Routing information is not collected (*9*). Rather, the BTS synthesizes routes as part of the post-survey analysis (*44*).
- Although CFS participation is mandatory, establishment response rates consistently have been on the order of 70% (*45*). Respondent burden has been cited as one reason, and the CFS form invites suggestions on ways to reduce this burden.
- The turnaround time for processing the data—on the order of 2 years—limits the information's timeliness and effectiveness. Moreover, the 5-year cycle cannot capture rapid changes in economic cycles or the impacts of new technologies or policies that might take place in the intervening years.
- The cost of the CFS is "substantial"—approximately $15 million in 1993, $19 million in 1997, $13 million in 2002 (*45*), and $14 million in 2007.

INTELLIGENT TRANSPORTATION SYSTEMS TECHNOLOGIES

GPS have been used in recent years to provide detailed and accurate data on vehicle location and speeds. A 2008 paper cited several potential benefits of GPS "to supplement, and eventually replace, data collected from roadside surveys," as follows (*11*):

- GPS are "nonintrusive," which get around "emerging privacy concerns [that] are making the conduct of roadside interviews more difficult."
- Availability of the technology is less of a concern than it once was, as the number of trucks equipped with GPS receivers has been increasing steadily in recent years.
- "Coverage of urban freight movement with detailed route origins and destinations and performance indicators [such as, travel time and delay].
- "Link-level congestion analysis, including travel time and speed.
- "Near real-time international border transit time monitoring [i.e., at approaches to international border crossings].
- "Tools and reporting systems to measure economic impacts of delays because of incidents.
- "Fuel consumption and pollution analysis using GPS units that include engine data retrievers.
- "Impacts of high-occupancy-vehicle lanes on general-purpose-lane traffic."

A 2007 paper reported on the use of GPS on 18,000 trucks traveling in Ontario, Canada. The monitored fleet includes 4,000 that were domiciled in the United States and Canadian trucks traveling extensively in the United States, thereby extending the geographic coverage of the monitoring. The low-cost GPS units were supplied by a third-party vendor on behalf of the provincial and federal transportation ministries at "low" costs to industry. This "low-cost technological solution with high resolution (polling every 700 feet or 20 to 30 seconds depending on speed and variance)" avoided "costly communication fees, compared to some satellite services." Data collected by each truck were stored on its GPS

and were downloaded daily to a receiver. Only the vendor had access to the raw GPS, thereby maintaining confidentiality and privacy. Selected data were provided to the transportation ministries, including time, location, instantaneous and average travel speeds over selected road and highway segments, "hardbrake" (sudden) deceleration, and fuel consumption; and only samples of these data were provided. No address information was provided. Of particular interest were the border crossings with the United States, where the monitored trucks provided "near real-time border wait times for trucks via the web, with a 15-minute delay in processing these data" (*46*).

Enquiries also have been made about the use of GPS as a means of guiding drivers. A 2005 freight operator survey in a London, U.K., suburb asked whether the operator's vehicles were equipped with automatic vehicle location equipment (that is, a GPS) (*47*).

Several studies have assessed the capabilities of GPS in providing freight data:

- A 2003 study in the state of Washington evaluated the performance of wireless transponders and GPS in providing "accurate" measurement of truck location and travel times, "to support regional and state transportation data collection efforts" in the Puget Sound region. The evaluation was based on field tests on vehicles at two local trucking companies. The evaluation found that the GPS units "showed promise." However, the high costs of collecting the data across the entire region, the high variability of the GPS data, and the difficulties of integrating the data with a geographic information system (GIS; that is, to display data graphically) were cited as limitations. Because the GPS data were vehicle-specific, other sources, such as freeway loop data, provided a more accurate depiction of actual operating conditions. By comparison, two truck transponder networks already had been in place for several years, and so the acquisition and processing of a large, robust sample of data was straightforward. The study recommended that GPS should not be deployed until the technologies and data processing software matured and costs came down, at which time a large-scale test should be conducted. In the meantime, the available transponder data should be incorporated into freight planning efforts to generate appropriate freight travel time statistics that could be used for modeling (*48*).
- A 2005 study reviewed five data collection technologies for potential use in measuring travel times along several Interstate corridors. The purpose of the review was to identify the technologies that could provide "the best combination of geographic and temporal coverage, density of observations, usability of data formats, and cost-effectiveness for collecting information on truck movements along the corridors." Although the study did not assess the technologies, it pointed out the following respective advantages and disadvantages (*49*):
  - Satellite GPS transmits a continuous or periodic signal to an earth orbit satellite. The GPS receiver is used to determine the vehicle's location based upon algorithms or a signal triangulation. The review found that this technology offered "superior service" in rural areas.
  - Terrestrial tracking is based upon analog or digital cellular technology, which uses multiple coverage base station areas. The benefit is the coverage provided within urban regions where satellites are not as effective. Disadvantages include limited coverage in rural areas and on Interstate highways, less precise locating capabilities than satellite GPS (50–150 meters), and multisystem interoperability problems.
  - Hybrid tracking systems combine elements of the two preceding technologies. New systems were combining terrestrial coverage in urban areas supported by satellite service in those areas where terrestrial coverage is not available. This minimizes overall system cost compared with a satellite tracking system while providing nationwide satellite coverage that is not available with the disparate terrestrial systems.
  - On-board computer tracking is the least advanced technology. The simplest and most labor-intensive form of vehicle tracking, it consists of cabin-mounted measuring/sensing processors that electronically or mechanically record such data as speed, idle time, and mileage. Benefits include being the least costly tracking option, its ubiquity (various forms of the technology exist in most vehicles), and its low cost for supplying simple statistics. Disadvantages include its relative lack of sophistication, limited data availability for the user, and in some systems the need for substantial manual processing to extract and analyze data.
  - Fixed site systems such as electronic toll collection systems (e.g., EZ Pass systems). Although these systems are in place along several Interstate sections, the number of sites is limited and off-corridor coverage is not feasible. The review found that these systems could not be used as a primary means of freight data collection but could be used to augment other systems.
- Two 2006 papers reported on a "benchmarking" study in Washington State. The study compared GPS with Commercial Vehicle Information Systems and Networks' automated vehicle identification (CVISN-AVI). One paper cited the high accuracy of GPS on travel routes and on individual road segments: "the advantage of the GPS devices is that they can monitor the actual route taken by instrumented vehicles. This makes the GPS [data] far more robust than the transpon-

der data." However, the primary disadvantage of GPS is the relatively small number of GPS-equipped trucks and, accordingly, "in a large metropolitan region insufficient data may be collected on many routes unless a fairly large sample of trucks actively participates in the data collection effort." Also, the GPS data collection requires "considerable staff effort" to coordinate, and a "mechanism for recruiting trucking company participation" is required (50). The second paper noted that CVISN-AVI-equipped vehicles were much more common and little labor was required to retrieve the data (compared with GPS), but data could be collected only at routes equipped with CVISN-AVI readers at weigh stations. Moreover, the data cover several trucks across long stretches of road, and specific points of congestion can be difficult to locate (*51*).

- A 2007 research survey in Peel Region, Canada (a suburb of Toronto), included a tour information form that was to be completed by the responding establishment's drivers. The form began with information at the start location; that is, the work location where the driver's "work day" began. Some of the vehicles were fitted with GPS units to enable comparison with the paper driver surveys. The combined data also were used to describe tours. The paper surveys faced significant stop nonreporting issues, such as truncated surveys, stops that were missing in the middle of a tour, and incorrectly or inaccurately recorded stop location information. At the same time, the GPS units provided a useful level of precision but did not capture well stops of short duration (of less than 5 minutes, which comprised a significant portion of the stops). Also, small differences in the identified (compared) stop locations resulted in some misinterpretations of the actual tour (*52*).
- Finally, a 2006 study proposed the use of optical character recognition (OCR) technology to collect vehicle license plates from trucks accessing selected terminals at the ports of Los Angeles and Long Beach. The purpose of the data collection was to develop an initial estimate of heavy-heavy-duty diesel truck activity and population, for application to the San Pedro bay Ports Clean Air Action Plan. To develop the estimate, data were collected for a continuous 37-day sample at five container terminals. The sample was considered representative of the Ports' 14 terminals. The OCR data were first analyzed to identify unique license plates and then to obtain the frequency of access to the Ports. The analysis yielded 15,700 unique license plates that comprised more than 253,000 trips. Of these, only vehicles registered in California were retained, resulting in approximately 12,000 vehicles and 244,000 trips that were used in the analysis. The remaining truck and trip records were categorized into three groups:
  - Frequent callers—trucks that visited the terminals one or more times daily (50.4%)
  - Semifrequent callers—trucks that visited at least every other day (30.3%)
  - Nonfrequent callers—trucks that visited less than once every other day (19.3%) (*53*).

COMPARISON OF TECHNIQUES

Some of the case studies described earlier compare alternate survey techniques, whereas others combine several techniques. A definitive description of the circumstances under which a particular type of survey should be used does not exist. However, three recent comparisons provide some guidance. They also illustrate the complexity of the topic and demonstrate how the definition varies according to the perspective.

A 2001 study identified two survey types among three types of truck data collection methods: roadside intercept surveys and travel diary surveys. The third method is vehicle classification counts. The three methods and the associated characteristics are listed in Table 28 (*54*). The roadside intercept and the travel diary surveys have long been used as an analytical basis for truck trip generation rates and modeling, and they often are accompanied by vehicle classification counts (in part to expand survey samples). This categorization also has been cited and expanded by other sources [e.g., (*9*)], but the general basis is common. However, the perspective is that of quantitative analysis and modeling which, although important, represents only part of the picture.

A 2004 study in Portland, Oregon, compared different truck trip data collection methods (*9*). One test examined roadside surveys along a highway, at a marine port, and at a private transportation depot/distribution center. Another series of tests examined different combinations of self-completion surveys (i.e., different combinations of mail-back or facsimile surveys with telephone contact and follow-up), with surveys sent to "known" samples (that is, establishments with which the sponsoring authorities had an established working relationship regarding other freight initiatives) and "unknown" samples (freight establishments without a prior contact).

The roadside surveys experienced high response and completion rates at all three locations, with some qualifications: the preponderance of container traffic at the port limited the driver's knowledge of payload information, obtaining detailed origin-destination addresses was difficult for all interviews (though less so for the distribution center interviewees), and finding large numbers of private firms to participate in this type of survey could prove challenging (*9*).

The mail-back and facsimile surveys presented more challenges, although they provided valuable information. There was no measurable difference in the response rate

or in the quality of the information between the known and unknown samples (i.e., familiarity did not make a difference). Both contained a "very high" percentage of incorrect and invalid information. The pre-survey and follow-up telephone contacts improved response rates overall, though not of completed questionnaires (in other words, increased contact was associated with increased refusal rates). Nonrespondents comprised almost half the known and unknown samples; follow-up contact might improve response rates. Respondents provided several reasons for not participating,

TABLE 29
METHODS BY WHICH URBAN FREIGHT SURVEY TECHNIQUES CAN BE CONDUCTED

1. Establishment surveys (surveys of the shipments made by businesses—the shippers and/or receivers of goods and services, with specific origin-destination information)	• Self-completion (post, fax, or e-mail) • Self-completion (post, fax, or e-mail with initial and reminder phone call) • Self-completion (left and collected in person) • Telephone interview • Face-to-face interview
2. Commodity flow survey (surveys of businesses on the quantities of goods shipped. Can include some origin-destination information)	• Self-completion (post, fax, or e-mail) • Self-completion (post, fax, or e-mail with initial and reminder phone call) • Self-completion (left and collected in person) • Telephone interview • Face-to-face interview
3. Freight operator survey (surveys of logistics managers of businesses or of carriers regarding the fleet's activities, including origin-destination)	• Self-completion (post, fax, or e-mail) • Self-completion (post, fax, or e-mail with initial and reminder phone call) • Self-completion (left and collected in person) • Telephone interview • Face-to-face interview
4. Driver survey (surveys of a driver's activities on his/her rounds for a given period)	• Self-completion (left in person) • Face-to-face interview
5. Roadside interview survey (surveys of the vehicle's activities for the trip being made when the vehicle is stopped for the interview)	• Face-to-face interview
6. Vehicle observation survey [observations by others of a vehicle's activities at a given site(s). Does not necessarily involve the vehicle driver]	• In-person observation • Observation using film/camera
7. Parking survey (observations by others of a vehicle's activities while it is parked or being loaded or unloaded at a stop)	• In-person observation • Observation using film/camera
8. Vehicle trip diaries (surveys of a vehicle's activities on its rounds for a given period. Similar to the driver survey but specific to the vehicle)	• Self-completion (post, fax, or e-mail) • Self-completion (post, fax, or e-mail with initial and reminder phone call) • Self-completion (left and collected in person)
9. GPS survey (electronic surveys of a vehicle's exact location. Also captures travel times)	• Equipment/transmitter fitted in vehicle
10. Suppliers survey (surveys of supplier businesses—suppliers to the supply chain—on the goods being shipped and on the supporting vehicle activity)	• Self-completion (post, fax, or e-mail) • Self-completion (post, fax, or e-mail with initial and reminder phone call) • Self-completion (left and collected in person) • Telephone interview • Face-to-face interview
11. Service providers survey (surveys of services-generating businesses regarding the characteristics of its employees' trips. Similar to freight operator survey but specific to services)	• Self-completion (post, fax, or e-mail) • Self-completion (post, fax, or e-mail with initial and reminder phone call) • Self-completion (left and collected in person) • Telephone interview • Face-to-face interview
12. Vehicle traffic counts	• Manual (in-person) counts • Automated counts (using sensors, film, cameras, or other technology)

Source: Allen and Browne (2008) (*2*).

TABLE 30
ADVANTAGES AND DISADVANTAGES OF METHODS FOR CONDUCTING URBAN FREIGHT SURVEYS

Survey Method	Advantages	Disadvantages
Face-to-face interviews and telephone surveys (for wide range of survey techniques including establishment, commodity flow, vehicle operator, shipper, and service provider surveys)	• High response rate compared with self-completion due to personal contact • Can provide better quality, more detailed information than self-completion method • Provides opportunity to query responses • Good for open-ended questions and in-depth discussion about responses • Easier to make follow-up contacts • Telephone surveys offer better opportunity to survey over large geographical area than face-to-face interviews • Face-to-face interview allows more in-depth discussion and use of other techniques (such as supply chain mapping etc.)	• More expensive and time consuming per respondent than self-completion (especially face-to-face interviews) • Can prove too expensive for a large sample size (especially face-to-face interviews) • Often difficult to obtain initial and participation and requires call backs
Self-completion surveys (for wide range of survey techniques including establishment, commodity flow, vehicle operator, shipper, and service provider surveys)	• Lower cost method than interviews of self-completion with initial contact • Permits larger and more representative samples than interviews • Offers better opportunity to survey over large geographical area than face-to-face interviews	• Generally lower response rates than with interviews or self-completion with initial contact. • Difficult to ensure that right person in organization will respond • No way of knowing whether respondent understood question in way intended • No opportunity to check/clarify or discuss responses • Difficult to interpret nonresponses to questions • Not good for open-ended questions
Self-completion with initial contact and reminder by phone call or in person (for wide range of survey techniques including establishment, commodity flow, vehicle operator, shipper, and service provider surveys)	• Lower cost method than interviews—effective method • Can provide better response rate than basic self completion method • Phone/in-person follow-up can allow opportunity to clarify/discuss responses (but difficult to achieve in practice) • Offers better opportunity to survey over large geographical area than face-to-face interviews	• More expensive than basic self completion method • Other disadvantages same as basic self-completion method
Roadside (face-to-face) interviews instead of vehicle trip diaries (self-completion) (for obtaining vehicle journey data)	• High response rate • Can provide information on trip purpose, goods carried and origin/destination, and route	• Disruption to traffic flow • Staffing requirements are high, making it expensive • No opportunity for follow-up with respondents • Requires involvement of police and/or other bodies • Does not provide details about entire journey and stops
In-person observation instead of using film/ camera (for vehicle observation/parking surveys)	• Reduced potential to cause traffic/ delivery disruption • No risk of equipment/ recording failure • Provides actual data about number and timing of deliveries and collections, unlike establishment survey	• Staffing requirements are high, making it expensive • Limited to hours/days of observation, so does not capture all activity • Neither in-person nor film observation can capture all delivery and collection activity, especially not of vehicles stopping off-street or in side roads
Manual traffic counts instead of automated traffic counts	• Reduced potential to cause traffic disruption • Complete disaggregation of vehicle type possible if trained surveyors used • Vehicles not wrongly identified • No risk of equipment failure	• Staffing requirements are high making it expensive • Difficult to collect traffic count data at many locations without it being very expensive

Source: Allen and Browne (2008) (2).

including privacy, inapplicability, lack of time, or unavailability of an appropriate person at that location. Information related to trip detail for inbound and outbound shipments was the most difficult to obtain through the mail survey (*9*).

Given these findings, and noting that these were pilot tests that were based on small samples, the study made several recommendations (*9*):

- Establish an updated freight contact list to improve the response rates and quality.
- Use roadside interviews as the basis for data collection for "inter- and intra-regional freight movements" at the three types of locations (highway, terminals, and private warehouse/distribution centers), and ensure that the survey sites are geographically distributed in the metropolitan (Portland) area.
- Use the mail-back/facsimile surveys of warehouses/distribution centers to complement the roadside interviews and gather selected pieces of information (notably, about the activity at the facility's location, and not about the trip detail).
- Use improved survey design techniques to improve the response rate.
- Employ all possible follow-up techniques, subject to budget.

Finally, a 2008 review of urban freight surveys compared survey techniques. Table 29 lists the techniques that are most commonly used for 11 survey types (and also includes vehicle traffic counts, because these commonly complement survey activities). The following are six basic survey techniques (*2*):

- Face-to-face interviews (i.e., at the establishment location) and telephone surveys.
- Self-completion surveys (mail-back or on the Internet).
- Self-completion survey, with initial contact and follow-up reminder by telephone or in person.
- Roadside (face-to-face) interviews, as distinct from self-completed driver surveys or vehicle trip diaries.
- In-person observation, instead of using film or camera (for vehicle observation or parking surveys; also has been used to capture driver or vehicle activity, through people accompanying the driver on his/her rounds).
- Manual traffic counts instead of automated traffic counts (i.e., to distinguish vehicle types in the counted traffic). This technique is identified in the source document as being relevant to urban freight surveys; however, it is not a survey type in itself.

Table 30 compares the survey types' relative advantages and disadvantages (*2*):

- Face-to-face interviews enable a high response rate, can provide better quality information and details, enable open-ended discussion and probing, and allow for both quantitative and qualitative input. However, they are expensive and time consuming.
- Telephone surveys have the same advantages as face-to-face interviews, and though they are also time consuming they can provide a less expensive means of capturing a larger sample size (per unit cost).
- Self-completion surveys have low unit costs and can reach a larger number of respondents. However, response rates typically are lower, and there is no control over the actual response, its level of detail, accuracy, or quality (i.e., questions can be misinterpreted or omitted), or whether the appropriate person is responding.
- Self-completion surveys with telephone or in-person follow-up provide the opportunity to improve response rate, clarify the questions, and otherwise guide respondents in completing the survey properly and completely. However, this approach is more expensive than the stand-alone self-completion surveys.
- Roadside interviews have a high response rate and allow for solicitation of detailed information of the trip at hand. However, they disrupt traffic flow, are expensive (because of staffing requirements), and are able to gather only limited information beyond the immediate trip.
- In-person observations (compared with filming or camera) provide data on actual conditions. However, they are expensive and are limited to the actual times of observation (i.e., no supplementary data).
- Manual traffic counts (compared with automated traffic counts) provide accurate data on vehicle types. However, staffing requirements make them expensive.

CHAPTER FIVE

SUMMARY AND CONCLUSIONS

SUMMARY OF FINDINGS

This synthesis has reviewed the state of the practice in freight transportation surveys, with a focus on truck freight in both urban and inter-urban settings. A survey of practitioners and a review of case studies found that freight transportation surveys, like the subject of freight transportation itself, are complex and multifaceted. A single, all-encompassing survey or data set does not exist; and perhaps as important, there is no commonly accepted taxonomy of survey types and definitions. Different types of surveys can be used to develop data for a given need (e.g., several types of surveys are used to gather trip origin-destination information). Neither generic survey designs nor commonly accepted survey contents exist. Many surveys combine quantitative and qualitative information-gathering: a review of recent MPO and statewide freight studies indicates that although freight surveys have been conducted, many of these are qualitative.

The synthesis profiles 12 different types of freight transportation surveys:

1. Roadside/intercept surveys
2. Combined telephone/mail-back surveys
3. Telephone interview surveys
4. Mail-out/mail-back surveys
5. Personal interview surveys
6. Internet surveys
7. Focus and stakeholder group surveys
8. Commercial vehicle trip diary surveys
9. GPS vehicle tracking surveys (more broadly, ITS technologies)
10. License plate match surveys—manual
11. License plate match surveys—electronic
12. Administrative surveys

(A thirteenth category accounted for "other" surveys, reported by respondents to the survey of practitioners but not otherwise categorized.)

A web-based survey of practitioners was the primary source of information for the synthesis. The survey was sent to all state departments of transportation (DOTs), as well as to selected metropolitan planning organizations (MPOs) that were known to be active in recent freight planning activities. These were the primary intended audiences. To further broaden the coverage, the survey also was sent to selected marine and airport authorities, academics, and commercial freight data purveyors. In total, 74 individual agencies were contacted. This generated 56 responses, including 45 state DOTs and eight MPOs. The survey of practitioners solicited information on several topics, including survey costs, practitioners' requirements for data, the data that are available to them and how these are used, and practitioners' use of ITS technologies for surveys and data collection. Practitioners also were asked to assess how well the available data met their needs.

The results provided a wide range of responses to virtually all the questions. However, some tendencies emerged from the state of the practice:

- The range of applications was broad, with the most common applications being policy and infrastructure capacity planning. Modeling was well down on the list: although data needs for modeling and forecasting were cited as an important reason for this synthesis, the findings indicate an interest in the use of freight surveys for many applications. The large number of "other" applications also suggests that new issues and needs are emerging and must be addressed.
- Trucks were the dominant mode of interest, but data for other modes also were of interest. There were some common elements in the type of data required for each mode: trip origin, destination, the characteristics of the load carried, and vehicle/vessel (equipment) profiles. Additional and more specific information was required for trucks, notably including speed and emission data.
- Among the 12 types of surveys, roadside/intercept surveys (i.e., the most traditional form of truck survey) were cited most frequently; however, each of the other types of surveys was used as well.

- Practitioners collected both qualitative and quantitative information. To some extent, this distinction also determines the type of survey that can be used—some types can be used to collect both qualitative and quantitative information, whereas others are usable for one or the other.
- Most practitioners indicated that they used external data sets to enhance their own databases. Among 21 public and commercial data sources presented to survey respondents, the U.S. DOT's Freight Analysis Framework, the Commodity Flow Survey and the TRANSEARCH Insight Database were used most commonly. Most users found the external data sources to be "adequate" or "good."
- Just over one-third of the practitioners (20 of 56 respondents) used Intelligent Transportation Systems (ITS) technologies, with weigh-in-motion (WIM) technologies and sensors being the most common application.
- Some practitioners found shortcomings in the available freight data, whether their own data or from external sources. Specific shortcomings (in decreasing frequency of citation) included insufficient detail or inappropriate scale (most commonly cited shortcoming, and common to several data sets); as well as high cost; incomplete coverage of the freight mode, movement, or commodity that is carried; datedness of the data; small sample size; incomplete geographical coverage; inadaptability of data developed for another purpose; and inapplicability of data definitions.
- Although practitioners identified several needs for their freight surveys (see Needs and Gaps Identified in the Literature and Resultant Recommendations for Research in this chapter), they also noted several factors for success in their data collection:
  - Adequacy of funding (the single most dominant theme)
  - Prior knowledge and experience in both the conduct of freight surveys and the analysis of the results, and among the actual surveyors
  - Appropriate survey planning aimed at addressing clearly specified objectives
  - Effective communications with and engagement of survey participants: related to this was the willingness of respondents to provide often-confidential information
  - Adequacy of responses, including specificity and level of detail
  - Timeliness and currency of the data (i.e., ensuring that the data are up to date and that they are processed quickly).
- Practitioners identified a range of costs for the conduct of their surveys. However, the costs lack precision, in part because of the lack of a common understanding of what components of the survey the costs comprised, and also the accompanying difficulty in allocating costs among these components (and between external and internal resources).

The survey was complemented by a literature review. Case studies for five survey types were identified, mainly from the United States but also from Canada and Europe. These comprised roadside/intercept surveys, focus and stakeholder group surveys, commercial trip diary surveys, establishment surveys, and ITS technologies. The range of case studies reflects a blend of the survey types that are used most commonly in practice, but also includes several research and comparison studies that reflect emerging practice (i.e., in the use of ITS techniques). A sixth presentation describes the U.S. Commodity Flow Survey, which is different from the 12 categories of interest in this synthesis and, accordingly, was not taken into account otherwise. The presentation also includes research studies on the comparison of techniques (notably, in the use of Global Positioning System (GPS), as well as summary descriptions of different survey techniques and applications.

The case studies were used to present different aspects of or variations to a specific type of survey: the types of information gathered are described. In several cases, the descriptions are complemented by illustrations of sample survey forms; however, it is important to note that many surveys of a specific type are similar and the selection of illustrations is not exhaustive. Finally, the description is complemented by discussions on four key topics: survey costs, the use of ITS technologies, a comparison of survey types, and the Commodity Flow Survey.

NEEDS AND GAPS IDENTIFIED BY PRACTITIONERS AND RESULTANT RECOMMENDATIONS FOR RESEARCH

A comprehensive survey of practitioners identified needs, current internal data collection efforts, usage of existing external public and commercial datasets, and an assessment of how well the internal and external data met users' needs. The key needs and gaps, and the recommended associated research needs, are as follows:

1. Despite the availability of many examples of surveys and information on the techniques for conducting them, as well as several public freight data sets, respondents identified the need for the specifics of a vehicle trip (e.g., origin, destination, routing, shipment details, travel time, emissions) as the greatest need. This applied to all freight modes as well as intermodal freight movement. This suggests the following research needs:
   - The conduct of demonstration surveys, to serve two purposes:

  - Comparing methods and demonstrating the practical obstacles and opportunities to their use in actual field situations. As reported herein, comparisons between GPS and other methods have been conducted; however, more detail is required on the actual operational, financial, and other benefits and costs associated with each method.
  - Recording the specific operational details of the survey as it is being conducted. The survey of practitioners and the literature review for this Synthesis found that very little detailed information was available. This need is exemplified by the lack of detailed cost information. Particular attention should be given to recording detailed costs by survey activity throughout the demonstration projects, given the difficulty in gathering this information from respondents after the survey.
- A detailed review of the efficacy of using existing public freight data sets as the basis for capturing vehicle trip information. The review should examine the feasibility of using these data sets as platforms for adding vehicle trip data as part of the data collection activity or for integrating separate vehicle trip surveys into them. The object of the review is to assess whether existing data sets could serve as practical, cost-effective means for providing the required data. Accordingly, the review should account for technical and statistical feasibility and integrity, and for practicality of use.

2. Practitioners were more familiar with "traditional" surveys, such as roadside/intercept surveys, than they were with ITS technologies. Moreover, insufficient capital resources was cited as a barrier to further use of ITS technologies. This suggests the need for research into ways of further establishing the monetary benefits of and reducing the costs of new technologies—in essence, the development of a "business case" for the introduction and application of ITS technologies, taking into account also the potential for emerging electronic technologies (perhaps being developed in other fields, not yet applied to transportation) to reduce costs, increase capabilities, and reduce processing time.

3. Practitioners identified several ways to improve deficiencies or gaps in their data collection. Most frequently cited, with greatest importance, were the need to provide more detail and ensure that data are collected regularly. This suggests that research should be conducted into the following approaches:
   - The practical application of survey techniques that are most effective in gathering the necessary details. Topics to be covered would include methods to increase sample size, exploration of new or improved existing data sources to serve as sample frames, and post-survey data treatments to address confidentiality concerns and allow detailed data to be made available.
   - The practical application of survey technologies to gain precision and detail. This would examine the use of ITS technologies to record precise routings and travel times, as described earlier, as well as to speed or improve data processing and validation (e.g., through the use of personal digital assostants to enter data directly). The research also should examine ways to increase the level of detail, establish a sufficient sample size to obviate confidentiality concerns, and the like.
   - Cost-effective and easily accessible survey methods (i.e., survey design, sources for sample frames) that promote increased data collection frequency and regularity. The object is to find ways to reduce costs and make it easier for agencies to implement ongoing survey programs and expand geographic or modal coverage. The research also should examine practical examples of how DOTs and MPOs have developed and integrated multiple data collection and survey programs to build upon existing data collection capabilities and reduce unit costs.
   - Methods that could reduce the processing, validation, and expansion time and costs required before survey results can be delivered.
   - The usability and cost-effectiveness of ongoing or more frequent survey instruments, to complement or replace "one-off" or infrequent surveys.

4. Overall, practitioners cited the need to improve existing surveys and capabilities. This suggests the need for—
   - A detailed guide for the conduct of freight surveys, with specific attention given to the practical considerations required for survey planning and conduct. The guide should be organized as a step-by-step guide, including the pre-survey preparation of required sample frames (because the experience of the Calgary survey demonstrates that compiling a directory of establishments can be an exercise in itself), sampling, institutional arrangements, interview techniques, post-survey processing, validation and analysis, and reporting.
   - Research on the design of survey questions to improve clarity, precision, and accuracy in order to improve the quality of responses and increase responses rates. (The detailed guide should also address questionnaire design.)
   - Research on the potential impact of new technologies and techniques to address legal and confidentiality issues.

5. Research on ways to build agency staff capabilities by educating and training analysts, and on ways to disseminate the practical aspects of the conduct of surveys, from survey design, the development of appropriate sampling frames, and ensuring sufficient samples to provide necessary detail, to recruitment techniques, staff training, and specific details on survey costs. Detailed documentation of all aspects of the survey process and its dissemination would be helpful in improving the overall capabilities and resource pool among public agencies.

NEEDS AND GAPS IDENTIFIED IN THE LITERATURE AND RESULTANT RECOMMENDATIONS FOR RESEARCH

Researchers have identified several gaps:

A 2008 United Kingdom study noted the need to "compare and validate" alternate techniques that could be used to gather the same type of information, in order to "determine the accuracy of each, and to investigate how both can potentially be enhanced to make up for any shortcomings they have" (*55*).

1. The Portland, Oregon, and Peel Region, Canada, comparisons of techniques are examples of this type of research (see Comparison of Techniques in chapter four).

2. The surveys described herein are multifaceted and generally are well established. However, they do not profile the characteristics of the complete supply chain involving the movement of a good from its true origin to its ultimate destination. Rather, individual segments of the chain tend to be captured. A 2007 review of freight data sources in Washington State identified the need to better understand the global supply chain and its manifestation in the movement of freight to, from, and within the state, as well as the workings of the distribution of goods produced in the state to domestic and international markets, and of the distribution of products to the consumer (*56*). This also implies the development of a better understanding of cross-border and international commodity flows.

3. A 2006 BESTUFS report identified the need to establish indicators that assess the performance of goods movement. In addition, there is a need to address a lack of a "common understanding or agreement about what constitutes an urban [in this case] freight transport indicator" (*57*).

4. A 2008 BESTUF report further identified the need to develop common definitions and terms (*58*).

OTHER RECOMMENDATIONS FOR RESEARCH

Although not identified specifically by practitioners or in the literature, several other recommendations can be drawn from the findings:

1. Development of a taxonomy of freight survey types, common definitions, and a common set of indicators of performance. These fundamental categorizations will help guide any subsequent detailing and analysis of surveys. Throughout the literature and among practitioners, there is a lack of clarity regarding the differences between *surveys* and the *techniques* that are used to conduct them (e.g., "roadside/intercepts" are a type of survey; "telephone" is a technique used to conduct a survey). A useful taxonomy is provided by a 2008 United Kingdom study that identified 11 distinct types of quantitative and qualitative surveys and then discussed different techniques for conducting them (*57*).

2. Development of methods to improve the precision and level of detail of existing surveys, notably through the integration of ITS technologies into the surveys.

3. Further comparison and assessment of all aspects of surveys, ranging from sample definition and selection to survey techniques and post-survey analysis. This comparison could be done through a series of pilot or site-specific tests, as exemplified by the research described in the preceding chapter.

4. Development of data collection and survey methods to detail the dynamics of the supply chain. Although this synthesis has touched on these, specific attention should be given to this emerging and somewhat difficult-to-define subject.

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GLOSSARY

This glossary has been compiled from references 25 (Ko et al. 2009) and 55 (Allen et al. 2008).

- **Automatic Traffic Recorder (ATR):** A recorder that captures directional speeds or records speeds as well as conducts rudimentary traffic counts. Commonly referred to as *tubes*.
- **Automated vehicle classification devices:** Monitoring devices used to establish the mix of vehicles in a traffic stream. These devices can vary substantially: some count axels, some use the "magnetic profile" over the loops, and some use the shape the vehicle projects through video.
- **Carrier:** A firm that transports goods or people via land, sea, or air.
- **Commercial vehicle movements:** The movement of vehicles involved in the transportation of goods or freight or the provision of services, such as appliance repair.
- **Commodity:** An item that is traded in commerce. The term usually implies an undifferentiated product competing primarily on price and availability. There are several standard commodity classification systems in use in North America.
- **Commodity flow:** A quantity of a specified commodity moving between a specified origin and destination region. Commodity quantities are usually given in terms of weight (tons) or value, and origin-destination regions are typically specified in terms of states/provinces, counties, or cities.
- **Commodity Flow Survey (CFS):** A survey conducted in the United States every 5 years as part of the Economic Census. The survey collects information about outbound goods shipments. Certain limitations in shipment coverage exist and are explained in literature provided by the Bureau of Transportation Statistics and the U.S. Bureau of the Census.
- **Drayage:** The movement of goods, generally by truck, from the primary shipper (or to the receiver) from the main shipment mode (e.g., goods trucked from a shipper to a port for export). Drayage moves are generally short-haul moves made by specialized carriers.
- **Economic data:** Data or statistics related to population, employment, operation and fuel costs, consumption information, and industry statistics.
- **Freight forwarder:** A person who acts as an agent on behalf of a shipper. A freight forwarder frequently consolidates shipments from several shippers and coordinates booking reservations.
- **Global Positioning System (GPS):** A satellite-based system of tracking the location of a transmitter/receiver. The system uses microwave communication with orbiting satellites to track the whereabouts of vehicles. These systems are increasingly used by trucking companies to obtain real-time information on the location of assets.
- **Hazardous material (HAZMAT):** A substance or material that the Department of Transportation has determined to be capable of posing a risk to health, safety, and property when stored or transported in commerce.
- **Intermodal terminal:** A location where links between different transportation modes and networks connect. Using more than one mode of transportation in moving persons and goods.
- **Land use data:** Information about the composition of land uses and plans for future land uses. Such data may include information about zoning or the location of infrastructure related to goods movement such as freight generators, industrial sites, and retail centers.
- **Logistics:** All activities involved in the management of product movement; delivering the right product from the right origin to the right destination, with the right quality and quantity, at the right schedule and price.
- **North American Industrial Classification System (NAICS):** A multi-tiered industrial classification system. Major industry groups are assigned a single numerical digit. Within each major group are more disaggregate industry categories (2-digit, 3-digit, 4-digit, etc.).
- **Payload:** The cargo carried by a truck.
- **Private trucking fleet:** A fleet of trucks owned by the shipper or receiver of goods. Trucks in private fleets are not for hire by other users.
- **Port Authorities:** State or local governments that own, operate, or otherwise provide wharf, dock, and other terminal investments at ports.
- **Public and commercial data sources:** Data sets that are purchased or acquired from an outside source.
- **Roadside survey:** A survey conducted by intercepting vehicles at a roadside location for the purpose of conducting a data collection interview.
- **Screenlines:** Artificial lines drawn across a set of facilities that generally serve the same origin and destination subareas within a metropolitan area. Screenlines are used to validate travel demand models by comparing the predicted traffic volumes at the screenline with those obtained from traffic counts.
- **Shipper:** The party that tenders goods for transportation.
- **Third-party logistics (3PL) providers:** Specialists in logistics who may provide a variety of transportation, warehousing, and logistics-related services to buyers

or sellers. These tasks were previously performed in-house by the customer.

- **Ton-mile:** A measure of output for freight transportation; reflects weight of shipment and the distance it is hauled; a multiplication of tons hauled by the distance traveled.
- **Tours:** Sets of linked trips beginning and ending at home base.
- **Traffic Analysis Zone (TAZ):** A location used in urban travel demand models to determine where trips originate and terminate.
- **Travel diaries:** A survey instrument used to collect information on individual trips. Travel diaries generally ask the user to record information on each trip, including starting and ending location, time of trips, distance of trips, and land use at trip ends.
- **Transportation network data:** Data about the supply and limitations of the greater transportation network. Data may include information about defined truck routes, HAZMAT mapping, truck size, height, and weight limitations, seasonal closures for waterways, short and long haul rail line locations, or other restrictions on goods movement.
- **Vehicle classification counts:** Traffic counts that classify the vehicles being counted. Classification counts distinguish trucks from automobiles and may distinguish trucks based on axle configuration, truck configuration, or body type. Vehicle classification counts can be taken manually (visual observation) or with machines.

APPENDIX B

Survey Respondents

State Department of Transportation	Alabama Department of Transportation
	Alaska Department of Transportation & Public Facilities
	Arizona Department of Transportation
	Arkansas State Highway and Transportation Department
	California Department of Transportation (two responses)
	Colorado Department of Transportation
	Connecticut Department of Transportation
	Delaware Department of Transportation
	District of Columbia Department of Transportation
	Florida Department of Transportation
	Georgia Department of Transportation
	Hawaii Department of Transportation
	Idaho Transportation Department
	Indiana Dept of Transportation
	Iowa Department of Transportation
	Kansas Department of Transportation
	Kentucky Transportation Cabinet
	Maine Highway Department
	Maryland Department of Transportation
	Massachusetts Highway Department
	Michigan Department of Transportation
	Minnesota Department of Transportation
	Missouri Department of Transportation
	Montana Department of Transportation
	Nebraska Department of Roads
	Nevada Department of Transportation
	New Hampshire Department of Transportation
	New Jersey Department of Transportation
	New Mexico Department of Transportation
	New York State Department of Transportation
	North Carolina Department of Transportation
	North Dakota Department of Transportation
	Ohio Department of Transportation
	Oklahoma Department of Transportation
	Pennsylvania Department of Transportation
	South Carolina Department of Transportation
	South Dakota Department of Transportation
	Tennessee Department of Transportation
	Texas Department of Transportation
	Vermont Agency of Transportation
	Virginia Department of Transportation
	Washington State Department of Transportation
	West Virginia Department of Transportation

Survey Respondents

	Wisconsin Department of Transportation
	Wyoming Department of Transportation
Metropolitan Planning Organization	Baltimore Metropolitan Council
	Hampton Roads MPO
	Maricopa Association of Governments
	Metropolitan Washington Council of Governments
	Metropolitan Transportation Commission (San Francisco Bay Area)
	Miami Dade MPO
	San Diego Regional Planning Agency
	Southern California Association of Governments
Marine Port or Airport Authority	The Port Authority of New York & New Jersey
	Massachusetts Port Authority

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